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PREHISTORIC REMAINS OF THE SWEET POTATO

FROM THE CASMA VALLEY OF PERU

Donald Ugent,[1] Shelia Pozorski,[2] and Thomas Pozorski[3]

Archaeological samples of the sweet potato (Ipomoea batatas Lam.) have been previously unearthed in the New World from only eight sites in central and south central Peru. Seven of these sites are on the desert coast. From the middens of Pachacamac and the Ancon necropolis have come specimens of tuberous roots dating from the Late Intermediate Period, A.D. 1000-1500 (Safford, 1917; Wittmack, 1880-1887); the burial fields at Paracas and Ocucaje in the Ica Valley and Cahuachi in the Nazca Valley have yielded plant remains from the late Early Horizon, 750 B.C.-A.D. 1 (Strong, in Towle, 1961; Tello, in Nordenskiold, 1931). Specimens from the late Cotton Preceramic period (1900-1750 B.C.) are represented by excavated collections from the central coast sites of Punta Grande and Tank Site, and Tank Site also yielded sweet potato in the subsequent early ceramic levels (Patterson, 1971; MacNeish et al, 1975; Cohen, 1978; Lanning 1965 and 1967; Patterson and Moseley, 1968).

The oldest specimens of the sweet potato so far known to science have come from the highland caves at Chilca Canyon, located some 65 kms south of Lima and at an altitude of over 2800 m. Radiocarbon dates associated with materials found along with three dried sweet potato roots suggest the caves were first occupied about 8000 B.C. (Engel, 1970).

Other chronologically much more recent remains of the sweet potato, dating from A.D. 800 to 1600, come from Easter Island, New Zealand and Hawaii. These collections, as well as current theories regarding the pre-Columbian introduction of the sweet potato from its putative homeland in Peru to the islands of the Pacific, are discussed at some length by Brand (1971), Yen (1971, 1974), O'Brien (1972) and Heyerdahl (1952, 1958).

In the present work, a collection of 18 roots of the sweet potato that were unearthed from the middens of one Preceramic (2000 B.C.) and two Initial Period (1800-1500 B.C.) sites situated near the coastal desert city of Casma in the Department of Ancash, Peru, is described. These samples represent the northernmost archaeological collections of this plant thus far known to science. The roots were positively identified as belonging to that of the sweet potato by their extant surface features and by their starch grains, which are unlike those known for any other cultivated root crop species.

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The plant remains described in this study derive from an on-going archaeological project of the second and third authors, and the material is currently in this country on loan from the Peruvian Instituto Nacional de Cultura. As additional collections of the sweet potato may be expected from future archaeological probings in this valley, the current study, as here set forth, must be considered as only preliminary.

ARCHAEOLOGICAL SETTING

Of the three sites in the Casma Valley where preserved remains of the sweet potato have already been found, the largest and most impressive in terms of areal extent and range of archaeological features is C1, or Pampa de las Llamas-Moxeke. This very early ceramic site is located about 20 km from the coast on the south branch of the Casma River (Fig. 1). It covers an area of about 220 hectares and includes both the mound of Moxeke and another large mound, this facing the first, as well as an extensive area of both small mounds and domestic architecture. Bordering the clusters of domestic architecture are the small mounded midden deposits which were sampled in connection with the present study. Although controlled stratigraphic excavations have been carried out at Pampa de las Llamas-Moxeke, the material available for this study came from a series of one meter square test pits dug into the various middens in order to gain a better understanding of their contents. Pottery and other artifacts unearthed from both these middens and the domestic structures of Pampa de las Llamas-Moxeke indicate that the occupation of this site dates to the Initial Period, 1800-1500 B.C. Specimens one through nine of the present study were found in various features of this site, and the first four of these were associated with tuber remains of the Solanum potato.

The second locality at which remains of the sweet potato have been found is designated C3 and is called Huaynuma. This preceramic site is about three hectares in area and occupies a protected area on a bay north of the Casma Valley (Fig. 1). No architecture is visible on the surface, but as a few walls were encountered during excavation of the site, it is evident that there were preceramic domestic structures and at least one small mound there. Some areas of the midden are up to two meters deep. The samples are from controlled stratigraphic excavations made by natural levels. These levels were numbered from the surface down as they were taken out, beginning with one, and unusually thick levels were divided into 10 to 15 cm artificial levels designated further by lower case letters. The age of the single tuberous root sample of the sweet potato (specimen 10) retrieved from this site is estimated at 2000 B.C. It was associated with plant remains of achira (Canna) and the Solanum potato.

The third site at which the sweet potato was found is called Tortugas and is designated C4. This early ceramic site lies on the coast north of Casma (Fig. 1). Much of the site has been destroyed by modern construction, but an area of midden over a meter deep lies undisturbed and was sampled in connection with the present study. On the basis of ceramics and other artifacts, it is believed that Tortugas is contemporary with

Pampa de las Llamas-Moxeke and dates to the Initial Period, about 1800-1500 B.C. As in the case of the Huaynuma provenience, the samples from Tortugas are from different levels within a controlled stratigraphic excavation. Specimens 11 through 18 are from this site. The Solanum potato was associated with specimen 11, and the Solanum potato and yam bean (or jicama) with specimens 14 through 18.

DESCRIPTION OF THE SPECIMENS

The procedures used in this section of the work for the staining and identification of starch grains are the same as those outlined by Whistler and Paschall (1967).

Sweet potatoes have compound starch grains ranging from 10 to 20 microns in diameter. When placed in water or stained with aqueous iodine solutions, these larger grains break apart into predominantly polyhedral granules, with some rounded (or shell-shaped), cap-shaped and faceted-round granules also present (Figs. 3 and 4). When mounted in glycerine and viewed by ordinary light microscope, or gold-palladium coated and observed by scanning electron microscope (Figs. 5B and C), they are seen to retain their true compound structure.

Also helpful in the identification of sweet potato remains is the presence of characteristic xylem vessel fragments in the starch preparations (Fig. 5D). These elements have sclariform-pitted walls and are quite fragile, appearing usually as bits and pieces of the whole cells in the preparations. Yam beans, which also have sclariform-pitted vessel elements, have a toughened vascular system which rarely comes apart in water. Moreover, the average size of the starch granules of this species are smaller than those of the sweet potato.

Lastly, it should be mentioned that color references in the following descriptions refer to the plates in Maerz and Paul's (1950) work, "A Dictionary of Color."

SPECIMEN 1 (Fig. 2A). Root fragment lacking a tip, irregularly conical, 30 mm long and 20 mm in diameter at the fractured top and 9 mm in diameter at the broken base. Skin rough, cracked and charred, without evident surface features, appearing elk brown (16-A11). Starch grains staining lightly with iodine-potassium iodide solution (Fig. 3A), the color mostly leaving the grains and darkening the surrounding medium. Granule size up to 30 microns in diameter, these appearing dark when stained with methylene blue. Sample weight 2.67 grams. Provenience data: Pampa de las Llamas-Moxeke; C1B-1=13, area B, test pit 9.

SPECIMEN 2 (Fig. 2B). Fragment probably of upper end of root, 28 mm long, 23 mm wide and about 8 mm thick. Skin striated, showing place of attachment of one lateral root, embedded with sand, debris and bits of wood charcoal, appearing gold brown (14-F12), the color of some modern varieties of sweet potato. Interior of root appearing granular, embedded with bits of charcoal. Starch granules staining medium-light with iodine-potassium iodide solution but darkly with methylene blue, the larger up to

30 microns long (Fig. 3B). Sample weight 1.51 grams. Provenience data: Pampa de las Llamas-Moxeke; C1B-1=13, area B, test pit 9.

SPECIMEN 3 (Fig. 2C). Fragment of root, 15 mm long, 11 mm wide and 7 mm thick. Skin striated, embedded with bits and pieces of wood charcoal, the color appearing gold brown (14-F12). Cortex of root granular, embedded with particles of charcoal. The compound starch grains (see SEM photos in Figs. 5B and C) breaking up into granules of about 35 microns maximum size, the granules staining darkly with iodine-potassium iodide solution (Fig. 3C). Weight of fragment 0.32 grams. Provenience data: Pampa de las Llamas-Moxeke; C1B-1=13, area B, test pit 9.

SPECIMEN 4 (Fig. 2D). Root entire, irregularly compressed-conical, with rounded shoulders and pointed tip representing connecting root attachment, 32 mm long, 13 mm wide and 9 mm thick. Skin longitudinally wrinkled and shriveled, embedded in places with debris and small bits and pieces of wood charcoal, the color raquet brown (15-C7). Starch granules staining very darkly with iodine-potassium iodide solution and methylene blue, the largest about 35 mm long (Fig. 3D). Root weight 0.96 grams. Provenience data: Pampa de las Llamas-Moxeke; C1B-1=28, area B, test pit 14.

SPECIMEN 5 (Fig. 2E). Lower root fragment, slightly twisted and irregularly conical, 34 mm long, 15 mm wide and 11 mm thick. Skin rough, wrinkled, cracked and damaged by rot, the color clove brown (16-A7). Cortex color coffee brown (15-A11). A single maggot pupa skin is found partially buried in the cortex of this specimen. Starch granules staining medium-light with iodine-potassium iodide solution and darkly with methylene blue, the larger about 40 microns long (Fig. 3E). Fragment weight 1.93 grams. Provenience data: Pampa de las Llamas-Moxeke; C1C-1=7, area C, test pit 3.

SPECIMEN 6 (Fig. 2F). Fragment of lower root, compressed-conical and slightly twisted, 34 mm long, 14 mm wide and 8 mm thick. Skin rough, cracked and wrinkled, damaged by rot, the color sparrow brown (15-C6). Cortex color mandalay (8-L12). Starch granules staining very lightly with iodine-potassium iodide solution (the color soon leaving the granules and staining the surrounding solution), and darkly with methylene blue, the larger about 25 microns long (Fig. 3F). Fragment weight 2.06 grams. Provenience data: Pampa de las Llamas-Moxeke; C1C-1=7, area C, test pit 3.

SPECIMEN 7 (Fig. 2G). Root entire, fusiform and slightly compressed, 31 mm long, 13 mm wide and 10 mm thick. Skin wrinkled, cracked, charred in some places and embedded with particles of charcoal, with some damage by rot, the color chukker brown (15-C8). Starch granules staining very darkly with iodine-potassium iodide solution, the larger 25 microns long (Fig. 3G). Root weight 1.59 grams. Provenience data: Pampa de las Llamas-Moxeke; C1C-1=7, area C, test pit 3.

SPECIMEN 8 (Fig. 2H). Tip of tuberous root, the fragment irregularly conical, 40 mm long and 29 mm in diameter. Skin longitudinally wrinkled, showing signs of damage by black rot, embedded with sand, debris and bits and pieces of wood charcoal, the color drab or beige (14-B5). Starch granules staining very light brown with iodine-potassium iodide solution

but darkly with methylene blue, the larger about 40 microns long (Fig. 3H). This sample, weighing 4.29 grams, is the heaviest known so far for the sweet potatoes of the Casma Valley. Provenience data: Pampa de las Llamas-Moxeke; C1C-1=7, area C, test pit 3.

SPECIMEN 9 (Fig. 2I). Fragment of upper portion of tuberous root, the shoulders rounded and provided with a short piece of connecting root, 21 mm long, 28 mm broad and 14 mm thick. Skin rough and flaked off in places, the color raquet brown (15-C7). Cortex embedded with bits and pieces of wood charcoal, the color chamois (11-I5). Starch granules staining darkly with iodine-potassium iodide solution, the larger about 40 microns long (Fig. 3I). Fragment weight 2.69 grams. Provenience data: Pampa de las Llamas-Moxeke; C1C-1=7, area C, test pit 3.

SPECIMEN 10 (Fig. 2J). Root nearly entire, compressed-fusiform and somewhat curved, 18 mm long, 8 mm wide and 6 mm thick. Skin present on one side only, rough, wrinkled and embedded with sand, debris and bits of wood charcoal, the color kangaroo brown (16-C6). Cortex color cocoa (7-E12). Starch granules staining darkly with iodine-potassium iodide solution, the larger 35 microns long (Fig. 4J). Sample weight 0.36 grams. Provenience data: Huaynuma: C3A-2=68, cut 2, square 1, level 4b.

SPECIMEN 11 (Fig. 2K). Root fragment irregularly conical, 20 mm long, 17 mm wide and 14 mm thick. Skin wrinkled, cracked, much encrusted with sand, debris and bits of wood charcoal and slightly charred in places, the color clove brown (16-A7). Cortex of root granular, laced with clear white salt crystals of about 1-2 mm in length, these appearing straight or somewhat curved (Fig. 5A). Cortex color castor brown (16-A8). Starch granules staining very darkly with iodine-potassium iodide solution, the larger 40 microns long (Fig. 4K). Sample weight 1.14 grams. Provenience data: Tortugas; C4A-2=39, cut 2, square 1, level 4b.

SPECIMEN 12 (Fig. 2L). Root entire, fusiform and slightly curved at tip, 18 mm long, 10 mm wide and 8 mm thick. Skin wrinkled, flaked off in places and embedded with grains of sand and wood charcoal, the color rose taupe (16-A4). Cortex color burnt umber (15-A12). Starch granules staining lightly with iodine-potassium iodide solution and darkly with methylene blue, the larger 25 microns long (Fig. 4L). Weight of root 0.61 grams. Provenience data: Tortugas; C4A-2=50, cut 2, square 1, level 8.

SPECIMEN 13 (Fig. 2M). Tip of tuberous root, the fragment curved-conical, 13 mm long, 10 mm wide and 7 mm thick. Skin smooth but tending to be papillose, the color rose taupe (16-A4). Cortex granular, embedded with grains of sand and bits of wood charcoal and appearing clove brown (16-A7). Starch granules staining medium-dark with iodine-potassium iodide solution, the larger 30 microns long (Fig. 4M). Fragment weight 0.22 grams. Provenience data: Tortugas; C4A-2=50, cut 2, square 1, level 8.

SPECIMEN 14 (Fig. 2N). Fragment of tuberous root irregularly curved-conical, 12 mm long, 12 mm wide and 4 mm thick. Skin lacking. Surface of cortex embedded with grains of sand, debris and bits of wood charcoal and appearing acorn brown (15-E7). Starch granules staining darkly with iodine-potassium iodide solution, the larger 25 microns long (Fig. 4N). Fragment weight 0.09 grams. Provenience data: Tortugas; C4A-2=84, cut 2, square 1, level 8.

SPECIMEN 15 (Fig. 2O). Root fusiform, twisted and broken at one end, 14 mm long, 5 mm wide and 4 mm thick. Skin rough and pitted and with a single fungal lesion, the color clove brown (16-A7). Starch granules dark staining with iodine-potassium iodide solution, the larger 25 microns long (Fig 4O). Sample weight 0.20 grams. Provenience data: Tortugas; C4A-2=84, cut 2, square 1, level 8.

SPECIMEN 16 (Fig. 2P). Root fragment irregularly curved-conical, 15 mm long, 12 mm wide and 8 mm thick. Skin smooth, charred, the color smoke brown (16-A2). Starch granules staining medium-dark with iodine-potassium iodide solution, the larger 25 microns long (Fig. 4P). Weight of fragment 0.50 grams. Provenience data: Tortugas; C4A-2=84, cut 2, square 1, level 8.

SPECIMEN 17 (Fig. 2Q). Pointed tuberous root fragment, irregularly conical, 14 mm long, 8 mm wide and 4 mm thick. Skin lacking. Cortex granular, containing clear crystals of about 1 mm in length, the overall color of the cortex appearing sparrow brown (15-C6). Starch granules very dark staining with iodine-potassium iodide solution, the larger 40 microns long (Fig. 4Q). Weighing 0.07 grams, this specimen is the smallest sample in our collection. Provenience data: Tortugas; C4A-2=84, cut 2, square 1, level 8.

SPECIMEN 18 (Fig. 2R). Curved lateral fragment of tuberous root, 27 mm long, 24 mm wide and 5 mm thick. Specimen very brittle (broken in two pieces during handling). Skin wrinkled and flaked off in places, appearing sparrow brown (15-C6). Cortex granular, embedded with sand grains and bits of wood charcoal, the overall color yellow biege (13-H7). Starch granules light staining with iodine-potassium iodide solution, the larger 25 microns long (Fig. 4R). Sample weight 0.79 grams. Provenience data: Tortugas; C4A-2=84, cut 2, square 1, level 8.

DISCUSSION

The remarkably excellent state of preservation of the sweet potatoes is due to the extreme aridity and constant climate of the sites from which they were obtained. According to ONERN (1972), the Casma region is one of the driest along the north coast, usually receiving less than 5 mm of rain a year. Tosi (1960) described the area as subtropical coastal desert, and gives the annual average temperature as 18°C.

Despite the low rainfall of this region, it is well known that crops have been grown locally along the various river valleys of the north coast for at least 4000 years (Pozorski and Pozorski, 1979). Initially, the method of cultivation was probably by flood water farming. People from as far away as Huaynuma may have seasonally grown crops in the lower reaches of the Casma Valley, using this method of farming.

By late preceramic times experimentation with canals was probably well underway, and this latter event soon gave rise to full scale irrigation farming. The existence of irrigation agriculture dating to the Initial Period has been postulated for the Moche Valley on the Peruvian north coast. Since midden deposits in both inland and coastal sites in the Moche Valley are a mixture of terrestrial and marine resources, it would appear that the crops grown under irrigation in the interior regions of this valley were regularly exchanged for ocean products which formed the economy of the downstream, coastal sites. A similar situation is believed to have existed with respect to the inland and coastal communities of the Casma Valley during Initial Period times. Here, evidence from middens points to Pampa de las Llamas-Moxeke and Tortugas as one such pair of symbiotic communities.

With regard to size, the sweet potato roots examined here are generally well within the range of other archaeological specimens of this crop taken from other sites. Yen (1974), for example, describes and illustrated a 10,000 year-old root of the sweet potato from Chilca Canyon which has a length of about 3 inches, or 76 mm. Similarly, a root of this crop collected by Ugent at Pachacamac in 1973 has a length of 60 mm. Starch grains (Fig. 5E) from this 1,000 year-old root are similar to ones found in the Casma series, and both fall within the range of variation of the starch drawn from the modern sweet potato (Fig. 5H).

The small size of the Casma roots as compared to the modern sample of the sweet potato shown in Fig. 5I, however, is another matter. The largest unbroken root from the three Casma sites examined here is only 31 mm long. However, one fragment (Fig. 2H) is 40 mm long and appears to represent about one-half of the original root. These dried samples, it should be remembered, have shrivelled to about one-half their original size, and have probably lost about 90% of their fresh weight.

While important, shrinkage is probably not the only factor which accounts for the smaller size of the ancient roots. It is possible that only the larger roots at the three Casma sites were eaten, whereas the smaller ones found their way into the midden heaps. Also, it must be remembered that the sweet potato has now undergone an additional 3800 years of artificial selections by man since its first known appearance in the Casma Valley.

Finally, it must be mentioned that the occurrence of charcoal fragments in the skin and interior cavities of the Casma sweet potato roots suggest that these were probably originally prepared by baking, perhaps by placement along the edge of an open camp fire. This method of preparation would appear to be especially logical for Huaynuma, as it is a preceramic site.

ACKNOWLEDGMENT

Appreciation is here extended to Mr. Howard Lee Brown of the Botany Department, Southern Illinois University, for his help in the preparation of the scanning electron microscope (SEM) photographs.

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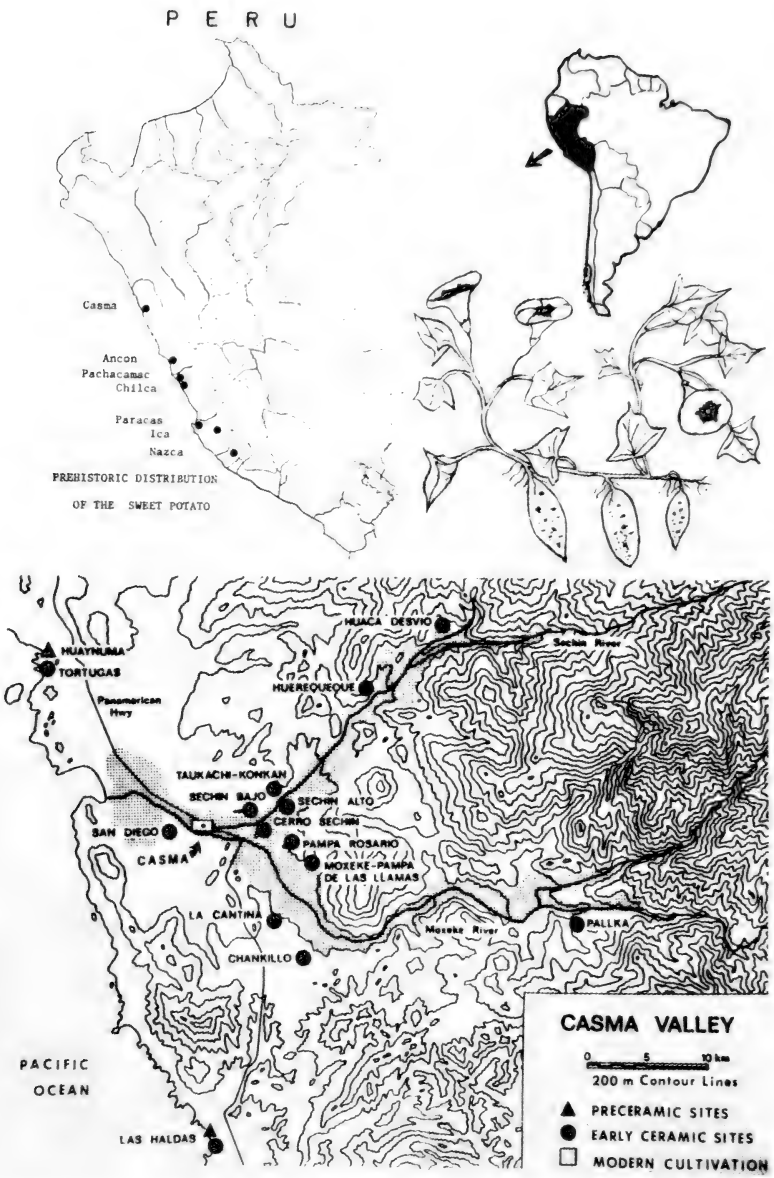


Figure 1. Past distribution of the sweet potato and location of the Casma Valley archaeological sites mentioned in the text.

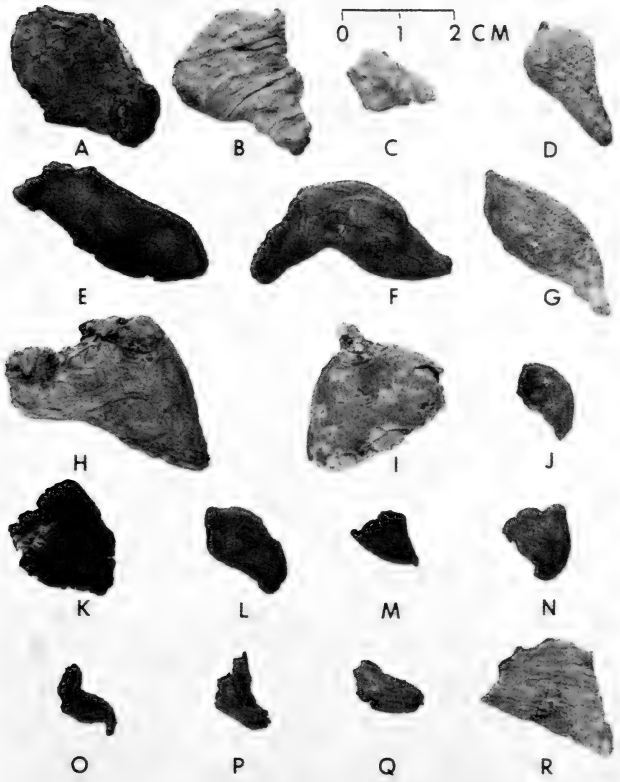


Fig. 2. Sweet potato remains from three archaeological sites in the vicinity of Casma, Peru. A-I. Root samples from Pampa de las Llamas-Moxeke. J. Specimen from Huaynuma. K-R. Collections from Tortugas.

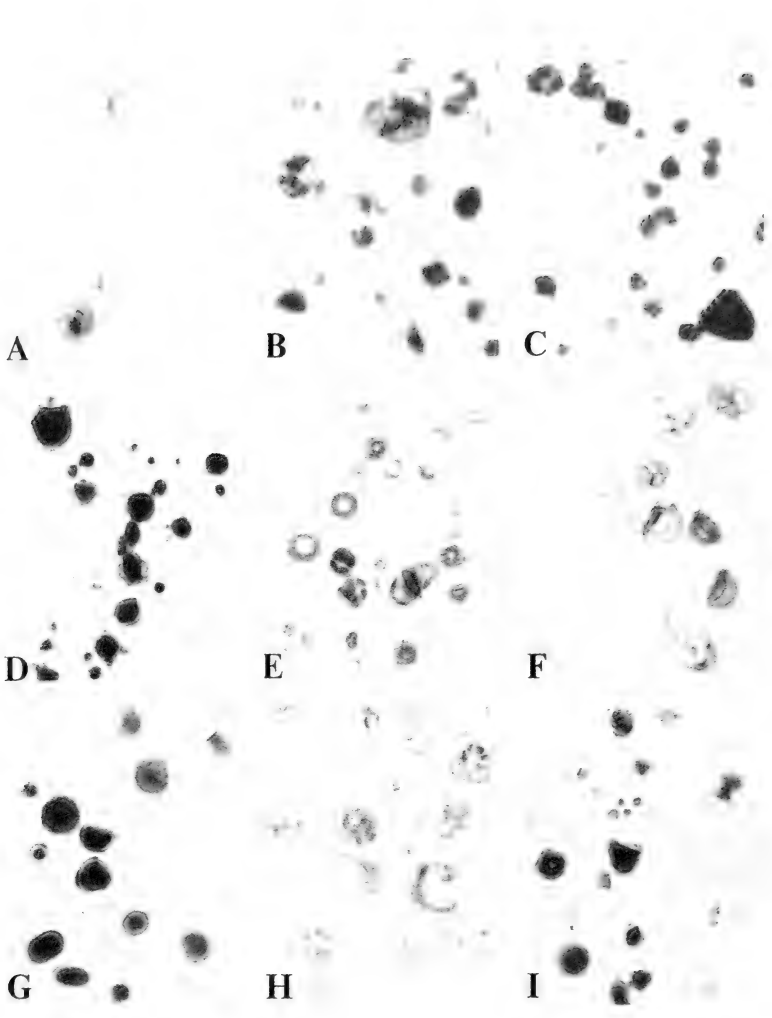


Fig. 3. Iodine-stained starch granules of preserved sweet potato roots (all phase contrast and 250 X). Refer to corresponding legends in text and in Figure 2 for further information.

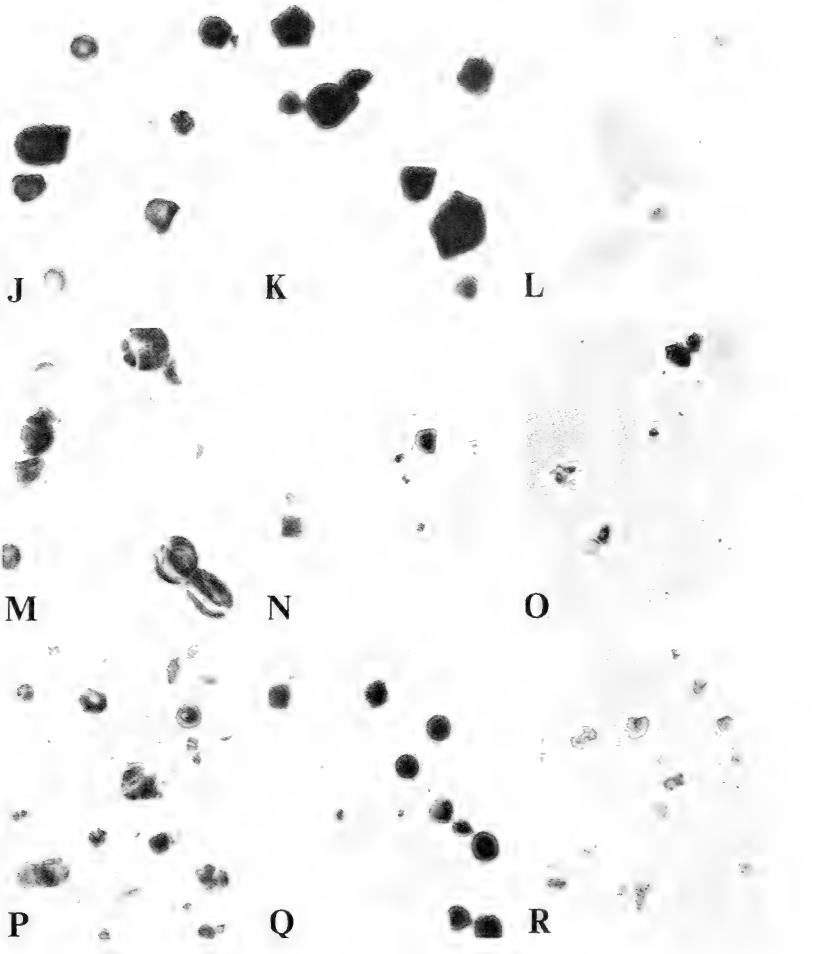
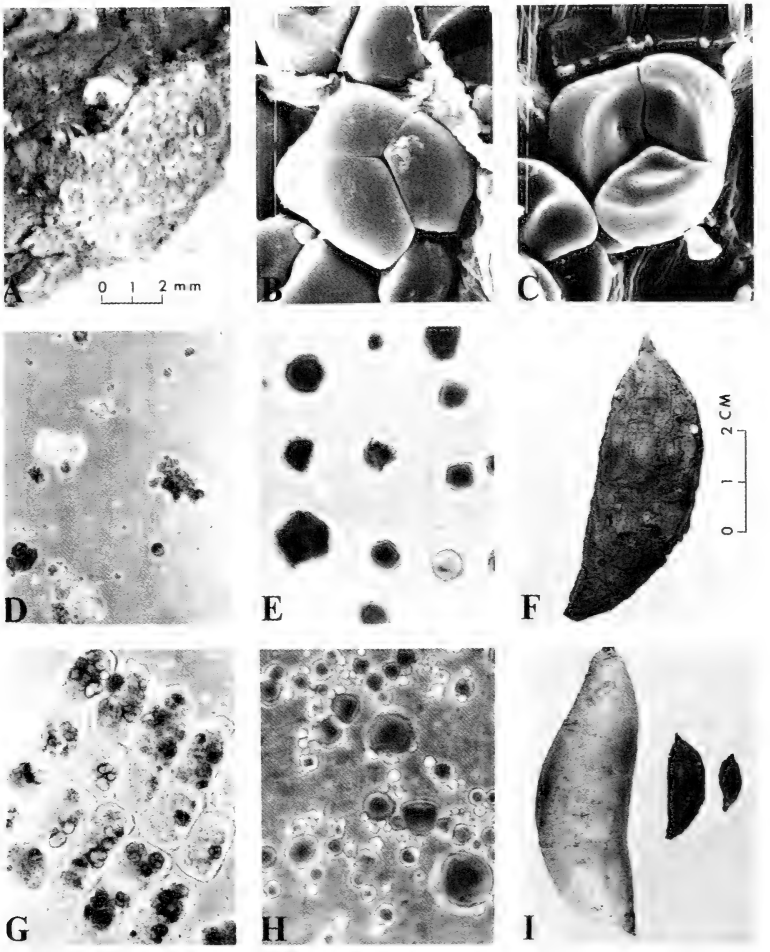


Fig. 4. Iodine-stained starch granules of preserved sweet potato roots (all phase contrast and 250 X). Refer to corresponding legends in text and in Figure 2 for further information.

Fig. 5. Illustrations of sweet potato cited in text. A. Broken cortical end of Tortugas root fragment (specimen 11), this showing curved, crystalline strand of water-soluble material arising from underside of skin. B. Scanning electron micrograph of compound starch grains from specimen 3, Pampas de las Llamas-Moxeke collection (gold-palladium coated, 2000 X). C. The same, but showing one of the grains lacking several of its smaller pieces, or granules. D. Fragment of xylem vessel and iodine-stained starch granules from the single Huaynuma root, specimen 10 (phase contrast, 160 X). E. Iodine-stained granules of a preserved root found at Pachacamac by Ugent (micrograph in phase contrast and at 250 X). F. Root from Pachacamac used in previously cited starch preparation. G. Iodine-stained starch grains in the cells of a freshly-grown sweet potato (phase contrast, 160 X). H. Iodine-stained starch granules of the modern sweet potato (phase contrast, 250 X). I. A fresh, medium-size (17 cm) root of the sweet potato as compared to archaeological samples from Pachacamac (center) and specimen 7 from Pampa de las Llamas-Moxeke (right).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STATISTICS OF CUPRESSUS CULTIVATION.

John Silba
198 W. Hoffman Ave., Lindenhurst, N. Y. 11757

A brief summary of growth statistics, hardiness and resistance to Cypress Canker of the Cupressus L. genus is given. This is based upon several references including Bailey (Hortus Third. 1977), Hillier (Hillier's Manual of Trees & Shrubs. 1978), Mitchell (Conifers in the British Isles. 1972), Mulligan (Intern. Dendr. Soc. Yr. Bk. 1975: 14-24. 1976) and Wolf (Aliso 1: 325-444. 1948). I have also had many personal correspondances with cypress specialists and keen plantsman.

In his revision, Silba (Phytologia 49: 390-399. 1981) recognized 15 species and 12 varieties of Cupressus. The genus is widely spread over the Northern Hemisphere, but in many instances the individual ranges are of quite limited extent. In the Old World they occur from Morocco to Iran then from the Himalaya thru southwest and central China. In the New World they occur from the southwest United States throughout Mexico to southern Guatemala and northwest Honduras.

As a whole cypresses are rare in cultivation, many kinds being confined to specialized collections in the arboreta. Cypresses are hardy trees, relatively free of insects and diseases and as such retain vigor well past the age of 100 years in the wild. Cultivated trees of C. sempervirens in Italy have reached over 1,900 years old.

The cypresses occupy a wide range of habitats and soils. The New World species are associated with acid, alkaline or serpentine soils, whereas the Old World species are associated with limestone or silty soils.

All species can be grown in USDA Plant Hardiness Zone 8 if properly positioned. They will grow in any common garden soil including shallow chalk, but do not enjoy damp sites. Due to their compact erect growth pruning is seldom required. Young plants should be planted in their permanent positions when 2-3 years old as many do not like root disturbance.

Seeds are the best means of propagation. These germinate readily and sporadically in 2-3 weeks from sowing. I have enjoyed good germination planting them in a 3/4 peat moss, 1/4 sand mixture planted in mid-February.

Horticultural Behaviour of Cypresses

Cupressus arizonica Greene. Rough-Bark Arizona cypress. Trees have reached 8.5 m in 10 years under favorable conditions. Hardy from USDA Zone 6 southward. Relatively immune to Cypress Canker. Many plants grown under this name are really var. glabra. Native in southeast Arizona to northern Mexico at 900-1830 m.

C. arizonica var. glabra (Sudw.) Little. Smooth-Bark Arizona cypress. To 8.5 m in 10 years. Relatively immune to Cypress Canker. Zone 7. From central Arizona at 1070-1676 m altitude.

C. arizonica var. montana (Wigg.) Little. San Pedro Martir cypress. To 6 m in 10 years. Relatively immune to Cypress Canker. Zone 7. From Baja California, Mexico at 2200-2825 m.

C. arizonica var. nevadensis (Abrams) Little. Piute cypress. To 7.3 m in 10 years. Slightly susceptible to Cypress Canker. Zone 7. From Kern County, California at 1524-1830 m.

C. arizonica var. Revealiana Silba. Reveal cypress. Few trees in cultivation exist. Faster in growth than var. nevadensis. Probably hardy in Zone 8, possibly Zone 7 if sheltered. Sierra Juarez, Baja California, Mexico at 450-1370 m.

C. arizonica var. Stephensonii (Wolf) Little. Cuyamaca cypress. To 4 m in 10 years. Relatively immune to Cypress Canker. Zone 8, possibly 7 if sheltered. Cuyamaca Mts, California at 1220-1740 m.

C. Bakeri Jeps. Baker cypress. To 5 m in 10 years. A cultivar, C. Bakeri 'Matthewsii' is much faster growing. Relatively immune to Cypress Canker. Zone 5 if sheltered. From northwest and northeast California at 1160-2100 m.

C. Chengiana Hu. Cheng or Min River cypress. To 6 m in 20 years. Few cultivated trees exist. Zone 8 if sheltered. From northeast Szechuan, China at 1300-3000 m.

C. Chengiana var. jiangeensis (Zhao) Silba. Jiange or Pine cypress. Apparently not in cultivation, but probably less hardy than the type. From Houyang Commune, Szechuan at 840 m.

C. Corneyana Carr. Corney or Weeping Bhutan cypress. To 8.3 m in 10 years. Zone 8, possibly 7 if sheltered. From Pho Chu Valley, Bhutan at 2550-3000 m.

C. Duclouxiana Hickel ex Camus. Ducloux or Yunnan cypress. To 2.5 m in 9 years. Rather resistant to Cypress Canker. Zone 8 if sheltered. Pome, southeast Tibet, China at 1950-2100 m.

C. funebris Endl. Chinese Weeping, Funebral or Mourning cypress. To 6 m in 20 years. Resistant to Cypress Canker. Zone 8, possibly 7 if sheltered. From Anwhei to Yunnan, central China at 1100-2000 m.

C. gigantea Cheng & Fu. Giant or Tsangpo River cypress. In one collection thusfar. Faster growing than C. Chengiana. From Jiage westwards, Tsangpo River, Tibet, China at 3000-3400 m. Probably hardier than C. Duclouxiana.

C. Goveniana Gord. Gowen cypress. To 8 m in 10 years. Highly susceptible to Cypress Canker. Zone 8. From Huckleberry Hill, Monterey Co, California at 60-248 m.

C. Goveniana var. Abramsiana (Wolf) Little. Santa Cruz cypress. To 10 m. in 10 years. Highly susceptible to Cypress Canker. Zone 8, possibly 7 if sheltered. Santa Cruz Mts, Santa Cruz Co, California at 487-762 m.

C. Goveniana var. pigmaea Lemm. Mendocino cypress. To 10 m in 10 years. Highly susceptible to Cypress Canker. Zone 8. Found nr Fort Bragg, Mendocino Co, California at 300 m.

C. guadalupensis Wats. Guadalupe cypress. To 8 m in 10 years. Less susceptible to Cypress Canker than var. Forbesii. Zone 8 if sheltered. Guadalupe Island, Mexico at 900 m.

C. guadalupensis var. Forbesii (Jeps.) Little. Forbes or Tecate cypress. To 10 m. in 10 years. Slightly susceptible to Cypress Canker. Zone 8. From southwest California and northwest Baja California at 460-1524 m.

C. lusitanica Mill. Mexican or Portuguese cypress. To 10 m in 10 years. It requires a more moist site than most kinds. Moderately susceptible to Cypress Canker. Zone 8. From north Mexico to southwest Guatemala and northwest Honduras at 490-1065 m. altitude.

C. lusitanica var. Benthamii (Endl.) Carr. Bentham cypress. Comparable in growth rate to the type. More resistant to Cypress Canker than the type, but needs shelter in Zone 8. From Hidalgo, Puebla and Vera Cruz, Mexico at 2100-2300 m.

C. Macnabiana Murr. MacNab cypress. To 6 m in 10 years. Rather susceptible to Cypress Canker. Zone 6 if sheltered. Good for bonzais. From northern California at 300-790 m.

C. macrocarpa Hartweg. Monterey cypress. To 10 m in 10 years. Highly susceptible to Cypress Canker. Zone 8 if sheltered. From Point Cypress, Monterey Co, California at sea level.

C. Sargentii Jeps. Sargent cypress. To 9 m in 10 years. Drought resistant. Highly susceptible to Cypress Canker. Zone 8, possibly 7 if sheltered. Seeds are difficult to germinate. From the California Coast Ranges at 60-1120 m.

C. sempervirens L. Spreading Mediterranean cypress. To 9 m in 10 years. Moderately susceptible to Cypress Canker. Drought resistant. Good for bonzais. Zone 8. In this species and others their clones (cultivars) are often hardier than the type. From Greece to Iran at usually 500-1800 m.

C. sempervirens var. atlantica (Gaussen) Silba. Intermediate in growth rate between the type and var. Dupreziana.The Atlas or Moroccan cypress is not as susceptible to Cypress Canker as the type. Zone 8, but sometimes needs shelter. Occuring in the Oued N'Fis, Morocco at 1000-2000 m.

C. sempervirens var. Dupreziana (Camus) Silba. Duprez, Saharan or Tamrit cypress. To 5.8 m in 10 years. Seed germination is very low. More resistant to Cypress Canker than the Moroccan cypress. Zone 8 if sheltered. Restricted to the Tassili Plateau, southeast Algeria at 1600-1900 m.

C. torulosa Don. Himalayan,Indian or Twisted cypress. To 3.85 m in 10 years. A cultivar, C. torulosa 'cashmeriana' is much faster growing, but quite tender. Some material grown as C. torulosa is really C. Corneyana. Relatively immune to Cypress Canker. Zone 8 if sheltered. From northeast India and northwest Nepal at 1500-3300 m.

Noteable Collections

The following arboreta listed have nearly all kinds of cypresses discussed here, but some plants are very young.

Castlewellan National Arboretum, Co. Down, N. Ireland

Ente Giardini Botanici Villa Taranto, Pallanza, Italy

Jermyns Arboretum, Ampfield, Hampshire, England

Station de Botanique et de Pathologie Vegetale, Antibes, France.

The John F. Kennedy Park, New Ross, Co. Wexford, Ireland

Wakehurst Place, Ardingly, Sussex, England

Commercial Sources

The following firms have propagating material of most kinds.

Clyde Robin Seed Co, P.O. Box 2855, Castro Valley, CA 94546

Etablissements Versepuy, Le Puy 4300, France . Bulk.

Frank T. Sesock, Seedsman, 6045 Foley Lane, Central Point, Oregon 97502. Bulk quantities.

Hillier Nurseries, Ampfield, Romsey, Hants SO5 9PA, England.

Plus Trees, Torrisdale, Campbeltown, Argyll, Scotland, U.K.

Tree Seeds of Bamber Bridge, Preston, Lancs PR5 6AP, England.

INDIGENOUS PLANTS USED IN URUGUAY FOR FERTILITY CONTROL

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INTRODUCTION

In Uruguay the use of medicinal plants is common. Our folk medicine mentions numerous species, most of them indigenous, used as emmenagogues and/or abortifacients.

In this paper we present ethnomedical information on indigenous plants used for fertility regulation in our country. Particular emphasis is placed upon those species that are presently used. Our exhaustive search for information is the first step of a project whose aim is to elucidate the pharmacological properties (and possible harmful side effects) of plant extracts used as antifertility agents in this part of the world.

METHODS

Ethnomedical information on vegetal agents used in Uruguay as emmenagogues and/or abortifacients was collected. The data obtained came mainly from 2 sources:
a) published compilations of tradions of the Uruguayan people, (1, 2, 4, 5),
b) oral information from 15 suppliers at marketstands.

RESULTS

Table 1 presents the list of 41 plants claimed by our folk medicine to be capable of regulating fertility in humans. The scientific name, popular name, and use is given for each plant. The species belong to the Uruguayense phytogeographical region (3) (fig.1).
All the plants are recommended to be used by women after one or more missed menstrual periods. No information was found about the use of plant preparations prior to expected menses of after a mid cycle coitus.
Among the plants, Adiantum cuneatum Langsd.& Fish., Aneimia tomentosa (Sav.) Sw., Margyricarpus pinnatus (Lam.)O.Ktze., Maytenus ilicifolia Mart., and Limonium brasiliensis Boiss., are presently used in our country.

Table 1: Indigenous plants used in Uruguay for fertility control.

Scientific name	Popular name	Use parts used*	prep**	conc.
Acanthospermum australe O.Ktze.	yerba de la oveja	lf.br.	dec.	5-10
Acaena eupatoria Bitter.	amor seco	pl.	te.	3
Achyrocline flavida (Lam.) DC.	marcela hembra	pl.	te.	?
Achyrocline satureoides Blake	marcela hembra	pl.	te.	1
Adiantum cuneatum Langsd.& Fish.	culandrillo	pl.	te.	1
Ambrosia tenuifolia Spreng.	altamisa	br.	te.	5
Aneimia tomentosa (Sav.) Sw.	doradilla	pl.	dec.	1-5
Apium leptophylum G.M.	apio de las piedras	lf.	te.	20
Apium sellowianum Wolff.	apio cimarrón	fr.lf.	te.	?
Aristolochia fimbriata Cham.	patito	br.	?	?
Baccharis trimera (Less.) DC	carqueja	br.	?	?
Cassia corymbosa Lam.	rama negra	r.	?	?
Cissampelos pareira L.	pareira brava	r.	te.	1-2
Chenopodium ambrosioides L.	paico	?	?	?
Dorstenia brasiliensis Hassler	contrayerba	r.	te.	1
Eupatorium inulaefolium H.B.K.	yerba charrúa	lf.	?	?
Glandularia peruviana Small.	margarita	?	?	?
Glandularia selloi (Spreng)Tronc.	margarita	?	te.	3
Gonphrena sp.	siempreviva	pl.	?	?
Heimia myrtifolia Link & Otto	quiebrarados	?	?	?
Heimia salicifolia C. & S.	quiebrarados	?	?	?
Heliotropium amplexicaule Vahl.	heliotropo	pl.	dec.	2
Limonium brasiliensis Boiss.	guaycurú	?	?	?
Margyricarpus pinnatus(Lam)O.Ktze.	yerba de la perdiz	br.	dec.	2
Maytenus ilicifolia Mart.	congorosa	lf.	te.	1-2
Ocimum selloi Benth.	albahaca del campo	lf.	te.	?
Passiflora coerulea L.	mburucuyá	r.br.	dec.	?
Passiflora foetida Mast.	mburucuyá	r.	te.	5
Phaffia sp.	batatilla purgante	pl.	?	?
Polygonum acuminatum H.B.K.	sanguinaria	?	te.	?
Polygonum brasiliensis Koch.	sanguinaria	pl.	te.	?
Polygonum punctatum Ell.	sanguinaria	pl.	?	?
Polypodium phyllitidis L.	calaguala	pl.	te.	10
Rumex cuneifolius Campd.	lengua de vaca	r.	dec.	2
Schinus molle L.	anacahuita	lf.	te.	1
Scutellaria racemosa Pers.	paleo, poleo	pl.	te.	?
Sisyrinchium vaginatum Spreng.	canchalagua	pl.	te.	?
Solanum sisymbriifolium Lam.	revienta caballos	r.	?	?
Trixis pallida Less.	solidonia blanca	pl.	te.	10
Trixis verbasciformis Less.	misionera	pl.	te.	10
Verbena Litoralis H.B.K.	verbena	r.fl.	?	?

* pl. whole plant; lf. leaves; br. branches, stems; r. roots; fl. flowers; fr. fruits.
**te. tea; dec. decoction

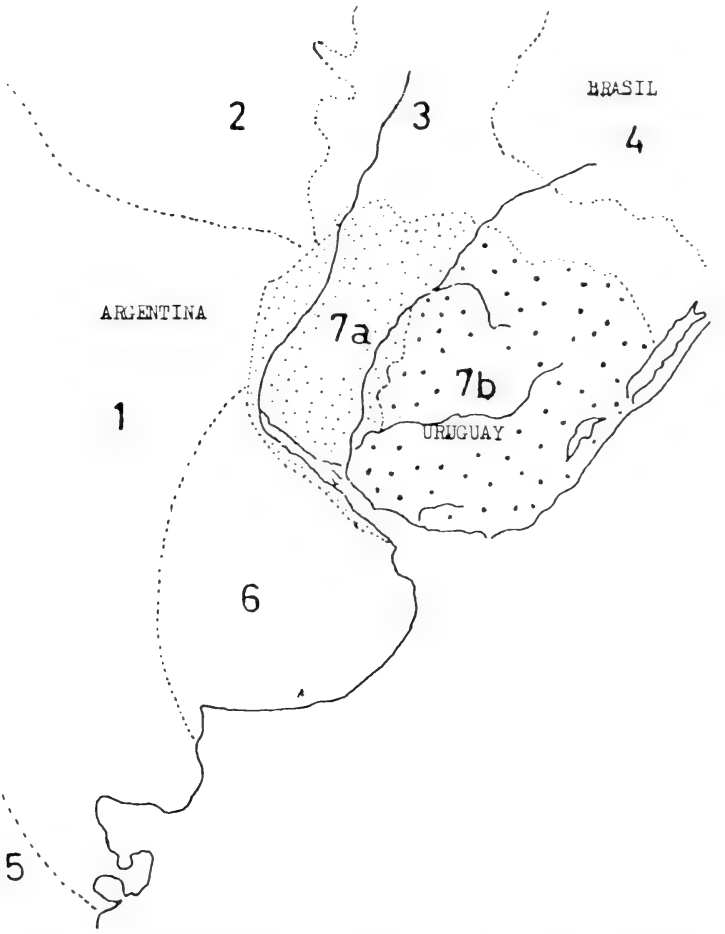

Fig. 1.- Phytogeographical provinces of the South Eastern region of South America. (3)
1. Monte Argentino 2. Chaqueña 3. Paraguayo-Correntina 4. Misionera 5. Patagónica 6. Pampeana 7. Uruguayense : a) Mesopotamia b) Uruguayense Oriental

DISCUSSION

The great number of plant species used for fertility regulation in Uruguay suggests the widespread popular use of vegetal extracts. It is also an unquestionable indication of a social need. Although several plants on this list have been reported to be used in other South American regions, and some of them already have been studied, no report has been published previously on the uses of plant species in the Uruguayense phytogeographical region.
We are testing at present the biodynamic properties of some species selected according to 2 criteria:
a) plants presently used by our people,
b) the most quoted plants in the ethnomedical literature reviewed by us.

ACKNOWLEDGMENTS

We are grateful to Prof. R. Brescia and Prof. E. Marchessi (Facultad de Agronomía, Montevideo, Uruguay) and Prof. B. Arrillaga de Maffei, (Facultad de Química y Farmacia, Montevideo, Uruguay).

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1.- Arrillaga de Maffei, B. Plantas Medicinales. Ed. Nuestra Tierra. Montevideo, Uruguay. 1969.
2.- Arrillaga de Maffei, B. Personal communication.
3.- Chebataroff, J. Algunos aspectos evolutivos de la vegetación de la Provincia Fitogeográfica Uruguayense. Revista Nacional 201,18 1960.
4.- Langón, M. Algunas plantas medicinales. Almanaque del Banco de Seguros del Estado. Montevideo, Uruguay. pp.86-93, 1924.
5.- Lombardo, A. Plantas medicinales de la flora indígena. Almanaque del Banco de Seguros del Estado. Montevideo, Uruguay. pp.103-113 1969; pp.177-186, 1973/74; pp.121-131, 1975/76; pp.133-143, 1977.

Variation in the Crotalaria breviflora complex in Brazil (Fabaceae)

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While revising Crotalaria of the Western Hemisphere, we encountered a problem in separating species related to C. breviflora DC.: C. breviflora DC., C. pohliana Benth. and C. subdecurrens Mart. This complex includes plants up to 2m tall with unifoliolate leaves and decurrent stipules. Its inflorescences are leaf-opposed and its yellow flowers are typical of Sect. Calycinae (Polhill 1968). The fruits are black at maturity. The chromosome number typical for the group is n=16. Its range extends into the Brazilian states of Goiás, Mato Grosso, Minas Gerais, Parana, Paraíba, Rio de Janeiro, and São Paulo. In 1859, Bentham separated C. breviflora and C. pohliana from C. subdecurrens by calyx length, with the former two having calyces 5-6 lines (10.5 - 12.6 mm) in length and the latter subpollicaris (to 27 mm). Bentham separated C. breviflora from C. pohliana by following characters:

C. pohliana - sparsely pubescent; leaves oblong; stipules short-decurrent with oblique truncate apices.

C. breviflora - appressed pubescent; leaves oval; stipules (procedentis?) with teeth longer.

During this study we have attempted to apply these criteria to specimens from 13 herbaria without any meaningful result. The complex is quite variable in calyx size, leaf shape and stipule width and development. This variability has led to a proliferation of specific and varietal epithets. In an effort to resolve the problem, the calyx size and stipule development were plotted on a map of Brazil. Calyx lengths tended to be smaller southward and eastward but there was some overlap. Poorly and well developed stipules occur throughout the range regardless of calyx length.

Since Bentham had used calyx size classes, leaf proportions and stipule characters to delimit species in the complex, we plotted leaf length/width ratios against calyx lengths for all available specimens on a scatter diagram to determine if a clear separation could be detected (Figure 1). The symbols form a dense cluster with only a few showing separation. Leaf shape varies from elliptic to lanceolate in plants of all calyx lengths and leaf length/width ratios. The notation for strong stipule development is also widely scattered in the cluster. Pubescence in the group ranges from appressed to spreading in plants of all flower sizes. None of these characters seem to provide an adequate basis for recognition of more than a single species.

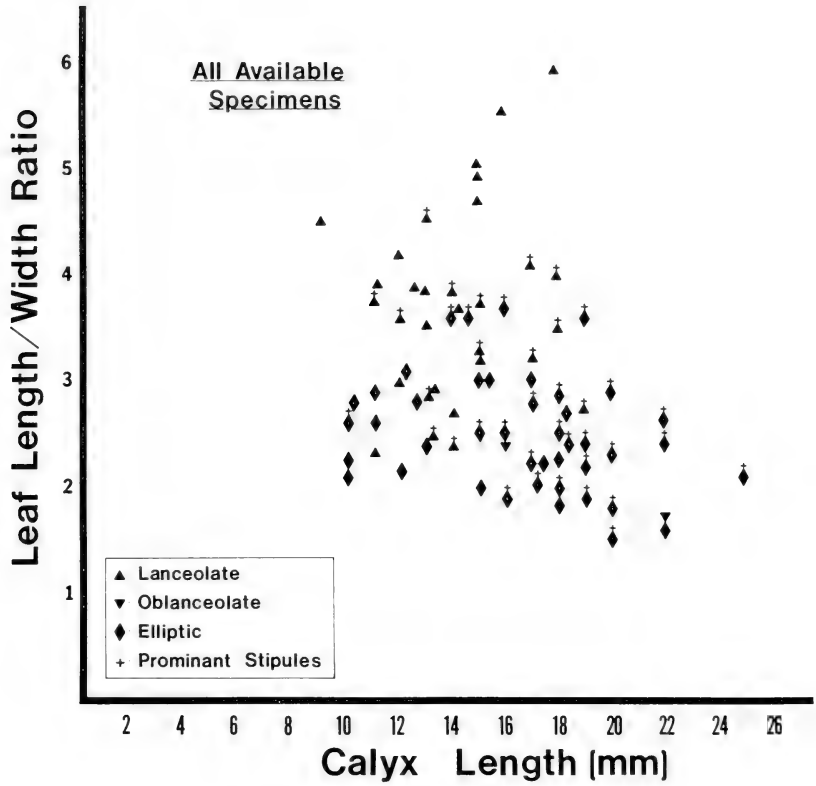

Figure 1. Combined specimens attributed to C. breviflora, C. pohliana and C. subdecurrens.

It was our good fortune to study a population sample of 14 specimens collected by Regnell at Caldas in Minas Gerais. A separate scatter diagram (Figure 2) was prepared from these specimens. In this single gathering calyx sizes range from 12 mm to 19 mm; leaf length/width ratios range from 2.0 to 5.6; leaf shapes range from elliptic to lanceolate; and pubescence ranges from appressed to loosely appressed to spreading. It appears that Regnell's sample ties all of Bentham's species in this complex together into one variable entity.

We feel that this variable complex is best treated as a single species C. breviflora, and that the entities previously treated as distinct species C. pohliana and C. subdecurrens should be reduced to one variety.

Distribution data and maps for this species will be presented in the revision to be published in Flora Neotropica.

Key to Varieties

Calyces 15.0 mm of less long, stipules usually weakly developed -- var breviflora

Calyces 15.1 mm or longer, stipules often well developed --------- var pohliana

Nomenclature

Crotalaria breviflora DC. Prodromus 2:127. 1825.
Type: Brazil, Delessert Herb. (Holotype G, Photos, NY, US)

Crotalaria breviflora DC. var breviflora

C. divergens Benth. Ann. Nat. Hist. 3:429. 1839. Type: Brazil, Goiás, Ourofino, Pohl s.n. (Holotype K, Herb. Bentham!)

C. regnellii Benth. Linnaea 22:511-2. 1849. Type: Brazil, Minas Gerais, Caldas, Regnell 65 (Holotype K!); C. pohliana var. regnellii (Benth.) Benth. in Martius, Flora Brasiliensis 15:20. 1859.

C. breviflora var. riedelii Taubert, Flora 72 (n.s. 47) 423. 1889. Type: Brazil, Minas Gerais, pr. Ytu, Riedel 2053 (Holotype B, not seen, photo, NY)

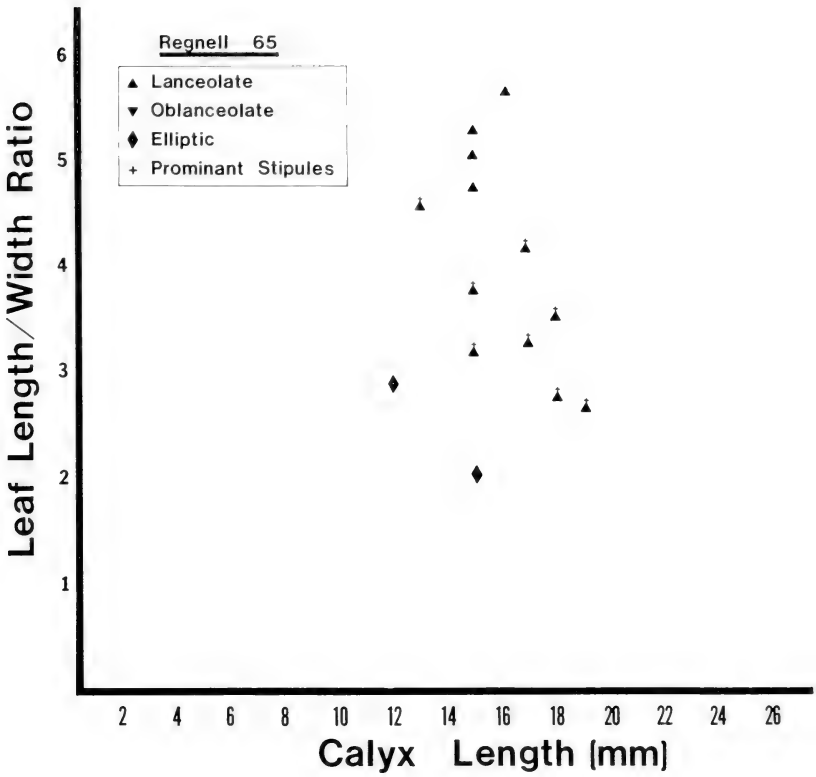

Figure 2. Specimens from a single location: Caldas in Minas Gerais.

Crotalaria breviflora var. pohliana (Benth.) Windler & Skinner, stat. nov.

C. pohliana Benth., Ann. Nat. Hist. 3:428. 1839. Type: Brazil, Rio Uruhu and Villa Boa, Limoeiro, Pohl 1121. 1608 (Holotype, K!; isotypes B!, W!)

C. ferruginea Scheele, Linnaea 21:571. 1848. (non Graham in Wallich 1831-1832, nom. nudum). Type: Brazil, Minas Gerais, Hartleben s.n. (Holotype probably destroyed at B)

C. subdecurrens Martius, Flora Brasiliensis 15:20. 1859. Type: Brazil, in campis ad Contendas, Martius 1606 (Lectotype M!)

Acknowledgements

The authors are indebted to the curators of the following herbaria from which specimens used in this paper were borrowed: BALT, BM, BR, F, G, IAN, K, MO, NY, P, RB, S, US, W. Scatter diagrams were prepared for publication by the Graphics Department, Towson State University. Thanks are also extended to Rupert Barneby, New York Botanical Gardens, for his criticism of the manuscript. Cost of publication was supported by the Towson State University Faculty Research Fund.

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Bentham, George (1859) in C. F. P. Von Martius, Flora Brasiliensis 15:20.

Polhill, R. M. (1968) Miscellaneous notes on African species of Crotalaria L.: II, Kew Bulletin 22:169-348.

NOTES ON NEW AND NOTEWORTHY PLANTS. CLII

Harold N. Moldenke

GEUNSIA HEXANDRA var. *MACROPHYLLA* Mold., var. nov.

Haec varietas a forma typica speciei laminis foliorum usque ad 41 cm. longis 15 cm. latis recedit.

This variety differs most conspicuously from the typical form of the species in having its leaf-blades to 41 cm. long and 15 cm. wide.

The variety is based on *Fedilis & Sumbing SAN.89702* from the side of a hill near a stream in the NBT logged-over area at mile 26 from Luasong, Tawau District, Sabah, collected on February 25, 1979, and deposited in my personal herbarium. The collectors note that the plant is a tree, 23 feet tall, the clear bole to 10 feet high and a girth of 6 inches, the bark "white brownish", the inner bark pale-greenish, the sapwood whitish, and the flowers [corollas] whitish-pink with a brown stalk".

GEUNSIA SCANDENS Mold., sp. nov.

Frutex scandens usque ad 10 m. longus, foliis oppositis anisophyllis, laminis foliorum firme chartaceis vel subcoriaceis late ellipticis 22--40 cm. longis 11--23 cm. latis apicaliter breviter acuminatis marginaliter integris basaliter acuminatis in petiolo decurrentibus supra adpresso-puberulis vel glabrescentibus subtus densissime ochraceo- vel griseo-tomentosis, inflorescentiis cymosis multifloris longe pedunculatis ca. 7 cm. longis 5 cm. latis ubique dense ferrugineo-tomentosis.

A woody climber, attaining a height of at least 10 m., the stem brownish, stout, very obtusely subtetragonal or subterete, densely floccose-tomentose with ferruginous hair; leaves (as far as observed) opposite, decidedly anisophyllous, one large and one small at each node; petioles very stout, 1.5--2.5 cm. long, flattened and canaliculate above, rounded beneath, densely floccose-tomentose, laterally bicostate because of the decurrent leaf-base; leaf-blades firmly chartaceous or even subcoriaceous, broadly elliptic, the smaller ones to 22 cm. long and 11 cm. wide, the larger ones to 40 cm. long and 23 cm. wide, apically short-acuminate, marginally entire, basally acuminate and decurrent into the petiole, appressed-puberulent and brunnescent in drying above, very densely ochraceous- or grayish-tomentose beneath; midrib stout, densely tomentose beneath and somewhat so above; secondaries 8 or more pairs, arcuate-ascending, very prominent beneath and slightly so above; veinlet reticulation prominulous beneath and under a handlens also so above; inflorescence cymose, axillary, pedunculate, rather small, many-flowered, dichotomous, densely ferruginous-tomentose throughout; peduncles about 4 cm. long; bracts few, linear, about 2 mm. long; mature flowers and fruit not seen.

This species is based on *Aban & Petrus SAN.90680* from a secondary forest on a steep slope near a road, at Ulu Sg, Lokan, Lamag District, Sabah, collected on November 10, 1979, and deposited in my personal

herbarium. The collectors note: "A woody climber 30 ft. long, stem brownish. Flowers purplish white. Leaves hairy."

LANTANA INVOLUCRATA var. *SOCORRENSIS* Mold., var. nov.

Haec varietas a forma typica speciei laminis foliorum suborbicularibus petiolis brevissimis aspectu sordido-flavidulis recedit.

This variety differs from the typical form of the species in its extremely abbreviated petioles, the suborbicular shape of its leaf-blades which are mostly less than 2 cm. long and wide, and the general sordid-yellowish aspect of the pubescence throughout.

The type of this apparently endemic Pacific coast variety of the typically West Indian species was collected by Reid Moran *(no. 5890)* on a hillside above the seashore in the vicinity of Academy Bay, Socorro Island, Mexico, near 18°50 3/4' N., 110°56 3/4' W., on March 16, 1957, and is deposited in the National Herbarium of the Instituto Biologica in Mexico City. The collector describes the plant as a low dense shrub to 4 dm. tall and 2 dm. wide, the numerous branches almost horizontal and interwoven.

LANTANA URTICOIDES f. *MACROPHYLLA* Mold., f. nov.

Haec forma a forma typica speciei laminis foliorum usque ad 11 cm. longis 7 cm. latis recedit.

This form differs from the typical form of the species in its leaf-blades being much larger, up to 11 cm. long and 7 cm. wide, and very coarsely dentate.

The form is based on *Rafael Hernández M. 424* from among low deciduous vegetation, at Tetasuari, San Bernardo, Sonora, Mexico, collected on July 13, 1967, and deposited in the National Herbarium of the Instituto de Biologia at Mexico City.

LIPPIA GRAVEOLENS f. *MACROPHYLLA* Mold., f. nov.

Haec forma a forma typica speciei laminis foliorum usque ad 7.5 cm. longis 3.5 cm. latis recedit.

This form differs from the typical form of the species in having its mature leaf-blades averaging much larger, to 7.5 cm. long and 3.5 cm. wide.

The form is based on *George B. Hinton 13162* from a bushy hillside, at 1700 m. altitude, between Zitacuaro and Coyota, Zitacuaro District, Michoacan, Mexico, collected on August 25, 1938, and deposited in my personal herbarium. The collector notes that the plant was 2 m. tall, fragrant, with white "flowers" [corollas].

TEIJSMANNIODENDRON SUBSPICATUM var. *ACUTIFOLIUM* Mold., var. nov.

Haec varietas a forma typica speciei laminis foliorum basaliter anguste acutis recedit.

This variety differs from the typical form of the species in having its leaf-blades regularly and gradually narrowed-acute at the base.

The type of the variety was collected by Aban G. and Petrus S. *(SAN.90237)* on a steep slope toward the river at the foot of Mount Mentapok, Kg. Miruru, Sabah, at 2000 m. altitude, on June 4, 1979, and is deposited in my personal herbarium.

VITEX PINNATA f. *PTILOTA* (Dop) Mold., comb. nov.
Vitex pubescens var. *ptilota* Dop, Bull. Soc. Hist. Nat. Toulouse 57: 198--199, pl. 2. 1928.

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ADDITIONAL NOTES ON THE GENUS *VITEX*. XXII

Harold N. Moldenke

VITEX PHAEOTRICHA Mildbr.
Additional & emended bibliography: Hutchins. & Dalz., Fl. W. Trop. Afr., ed. 1, 2: 275 & 276. 1931; Emberger in Chadefaud & Emberger, Trait. Bot. 2: 830, fig. 1176. 1960; Mold., Fifth Summ. 1: 219, 220, & 224 (1971) and 2: 722, 727, & 928. 1971; Mold., Phytologia 28: 465 (1974) and 44: 408. 1979; Mold., Phytol. Mem. 2: 209, 210, 215, 459, & 593. 1980; Mold., Phytologia 49: 384. 1981.
Additional illustrations: Emberger in Chadefaud & Emberger, Trait. Bot. 2: 830, fig. 1176. 1960.
Additional citations: LIBERIA: *J. T. Baldwin 9155* (W--2672792); *Mayer 58* (W--2630492, Z).

VITEX PHASEOLIFOLIA Mildbr.
Additional bibliography: Fedde & Schust., Justs Bot. Jahresber. 57 (2): 402. 1938; Mold., Phytologia 15: 323. 1967; Mold., Fifth Summ. 1: 224 (1971) and 2: 710 & 928. 1971; Mold., Phytologia 44: 224 & 225. 1979; Mold., Phytol. Mem. 2: 215 & 593. 1980.
Breteler describes this plant as a liana growing in a 10-meters-tall tree, the bark corky, peeling off in small elongate thin flakes, the wood pale-yellow, the leaf-blades papery, glossy, medium- to dark-green above, pale-green beneath with a red-brown midrib, the calyx brownish-green, the corolla yellowish, red at the base, and the fruits obovoid, orange-yellow, 11 mm. long, 9 mm. wide, smooth, glossy. He encountered the plant in secondary forests, in flower and fruit in April. A wood sample accompanies his collection.
Additional citations: CAMEROONS: *Breteler 1269* (Mu, Z).

VITEX PHILLYREAEFOLIA J. G. Baker
Additional bibliography: Mold., Phytologia 15: 323. 1967; Mold., Fifth Summ. 1: 263 (1971) and 2: 726 & 928. 1971; Mold., Phytol. Mem. 2: 252 & 593. 1980.

VITEX PIERREANA Dop
Additional & emended bibliography: Dop, Bull. Soc. Hist. Nat. Toulouse 57: 205, 210, & 211. 1928; Fedde & Schust., Justs Bot. Jahresber. 56 (2): 286. 1937; Mold., Phytologia 15: 323. 1967; Mold., Fifth Summ. 1: 293 & 303 (1971) and 2: 726, 776, & 928. 1971; Mold., Phytol. Mem. 2: 282, 294, & 593. 1980; Mold., Phytolo-

gia 49: 381. 1981.

VITEX PIERREI Craib

Additional & emended bibliography: Fedde & Schust., Justs Bot. Jahresber. 46 (2): 195. 1925; Fletcher, Kew Bull. Misc. Inf. 1938: 405, 407, 431, & 433. 1938; Mold., Phytologia 17: 22. 1968; Mold., Fifth Summ. 1: 298 & 303 (1971) and 2: 776 & 928. 1971; Mold., Phytol. Mem. 2: 288, 294, & 593. 1980.

Recent collectors describe this plant as a shrub, 1--2 m. tall, or a tree, 5 m. tall, sparsely leaved, the calyx green, and the fruit at first green, later blackish, and have found it along roadsides at the edges of forests, in open thickets on dry dipterocarp savannas on sandstone bedrock, in woods, forests, and mixed forests, and in alluvial gray podzolic soil, at 5--600 m. altitude, "apparently not common". Addor collected his specimens from "a single lateral stem arising from a prostrate tree" and as "apparently suckers broken off from a small tree". The corollas are described as "tube red. lobes light-yellow" on *Maxwell 76-537*.

Fletcher (1938) cites *Collins 72, 73,* & *706* and *Kerr 4851* from Thailand, asserting that *Collins 72* & *73* are "types". He lists the species also from Cochinchina.

The *Squires 777* & *861,* distributed as *V. pierrei,* actually are *V. peduncularis* Wall.

Additional citations: THAILAND: *Maxwell 76-537* (Ac). VIETNAM: *Addor 1498* (W--2623962), *1505* (W--2623954).

VITEX PINNATA L.

Additional & emended synonymy: *Katoŭ-mail-elou* Rheede, Hort. Malab. 5: pl. 2. 1685. *Katou-mail-elou* Rheede, Hort. Malab. 5: 3--4. 1685. *Katou-mal* Rheede, Hort. Malab. 4: 4. 1685. *Scatou-mail-elou* Rheede apud Breyne, Prod. Fasc. Rar. Pl., ed. 1, 2: 106. 1688. *Vitex maxima indica, fructu carnoso, floribus majoribus & densioribus* Breyne, Prod. Fasc. Rar. Pl., ed. 1, 2: 106. 1688. *Pistacia-Vitex* L., Fl. Zeyl., imp. 1, 195. 1747. *Anonyma* Herm. ex L., Fl. Zeyl., imp. 1, 195. 1747 [not *Anonyma* Plum., 1737]. *Vitex arborea* Roxb., Hort. Beng., imp. 1, 46, hyponym. 1814; Fl. Ind., ed. 2, imp. 1, 3: 73. 1832 [not *V. arborea* Brĕon, 1944, nor Brown, 1806, nor Desf., 1847, nor Fischer, 1829]. *Vitex heterophylla* H. B. ex Sweet, Hort. Brit., ed. 2, 416. 1830. *Vitex digitata* Wight ex Wall., Numer. List 86, no. 1747 J, hyponym. 1831. *Vitex pubescens* Llanos ex Wall., Numer. List 86, no. 1747 K, hyponym. 1831. *Pistacia vitex* L. apud Decne., Nouv. Ann. Mus. Hist. Nat. Paris 3: 401, in syn. 1834. *Vitex pubescens* (Vahl) Schau. ex Wight, Icon. Pl. Ind. Orient. 4: pl. 1465 in textu. 1849. *Vitex bracteata* Miq. ex Pételot, Pl. Méd. Camb. Laos Vietn. 2: [Archiv. Recherch. Agron. Past. Vietn. 18:] 250. 1953. *Katoŭ-mail-eloŭ* Rheede apud Mold., Phytologia 6: 51, in syn. 1957. *Vitex latifolia* Vahl ex Mold., Phytologia 6: 62, in syn. 1957. *Vitex pinnata* var. *pinnata* [L.] ex Hocking, Excerpt. Bot. A.13: 570. 1968.

Additional & emended bibliography: Breyne, Prod. Fasc. Rar. Pl., ed. 1, 2: 102. 1688; L., Hort. Cliff. 319. 1737; Bryene, Prod. Fasc. Rar. Pl., ed. 2, 2: 106. 1739; L., Fl. Zeyl., imp. 1, 195

(1747) and imp. 2, 195. 1748; L., Sp. Pl., ed. 1, imp. 1, 638 (1753) and ed. 2, 2: 890. 1763; N. L. Burm., Fl. Ind. 138, pl. 43. 1768; Raeusch., Nom. Bot., ed. 3, 182. 1797; Roxb., Hort. Beng., imp. 1, 46. 1814; Jack, Malay. Misc., imp. 1, 1 (1): 18--19 & opp. A. 1820; Wall. in Roxb., Fl. Ind., ed. 1, imp. 1, 1: 482. 1820; Roth, Nov. Pl. Sp., imp. 1, 317--318. 1821; Moon, Cat. Indig. Exot. Pl. Ceyl. 1: 46. 1824; Blume, Bijdr. Fl. Ned. Ind. 14: 812--813. 1826; Wall., Numer. List [47], no. 1747 (1--5). 1829; Loud., Hort. Brit., ed. 1, 246. 1830; Sweet, Hort. Brit., ed. 2, 416. 1830; Wall., Numer. List 86, no. 1747 F, G, & K. 1831; Loud., Hort. Brit., ed. 2, 246. 1832; Roxb., Fl. Ind., ed. 2, imp. 1, 3: 73--74. 1832; G. Don in Loud., Hort. Brit., ed. 3, 246. 1839; G. Don in Sweet, Hort. Brit., ed. 3, 557. 1839; Thwaites, Enum. Pl. Zeyl. 2: 244. 1839; Spach, Hist. Nat. Vég. 9: 231--232. 1840; D. Dietr., Syn. Pl. 3: 610 & 611. 1843; W. Jack, Calc. Journ. Nat. Hist. 4 (13): 40--41. 1843; Hassk., Cat. Pl. Hort. Bot. Bogor. Cult. Alt. 134. 1844; Voigt, Hort. Suburb. Calc. 469. 1845; Schau. in A. DC., Prodr. 11: 685--686 &696. 1847; Wight, Icon. Pl. Ind. Orient. 4 (3): 11, pl. 1465. 1849; Loud., Hort. Brit., ed. 2, Suppl. [3]: 657. 1850; Buek, Gen. Spec. Syn. Candoll. 3: 501 & 502. 1858; Miq., Fl. Ind. Bat. Suppl. 1: 95 & 242. 1860; Thwaites & Hook. f., Enum. Pl. Zeyl., imp. 1, 244. 1861; Roxb., Fl. Ind., ed. 2, imp. 2, 482--483. 1874; Kurz, Forest Fl. Brit. Burma 2: 269, 271, & 612. 1877; Naves & Fern.-Villar in Blanco, Fl. Filip., ed. 3, 6: pl. 427 (1878) and ed. 3, 4: 160. 1880; Gamble, Man. Indian Timb., ed. 1, 297--298 & 522. 1881; Vidal, Sin. Fam. Gen. Pl. Leñ. Filip. [Introd. Fl. For. Filip.] 2: 35, pl. 75, fig. A. 1883; Hemsl. in Thomson & Murray, Rep. Scient. Res. Voy. Challenger 3, Bot. 1: 110 & 178. 1885; Trimen, Journ. Ceyl. Br. Roy. Asiat. Soc. 9: [Syst. Cat. Flow. Pl. Ceyl.] 69. 1885; Trimen, Handb. Fl. Ceyl. 358. 1895; Ridl., Agric. Journ. Straits Fed. Mal. St. 1902: 218--219. 1902; F. N. Williams, Bull. Herb. Boiss., ser. 2, 5: 431. 1905; Brandis, Indian Trees, imp. 1, 504. 1906; A. Rodger, Working Plan Tagaung Circle par. 13. 1909; W. & J. Leeuwen-Reijnvaan, Marcellia 11: 49--55. 1912; Schneid., Bull. Bur. Forest. Philip. 14: 209. 1916; Dalla Torre, Justs Bot. Jahresber. 40 (1): 778. 1917; Heyne, Nutt. Plant. Ned. Ind., ed. 1, 4: 114--116. 1917; H. Hallier, Meded. Rijks Herb. Leid. 37: 44--45. 1918; Kirtikar & Basu, Indian Med. Pl., ed. 1, 1936 & 1943--1944. 1918; E. D. Merr., Sp. Blanc. 333. 1918; Foxworthy, Malay. Forest. Rec. 1: 105. 1921; E. D. Merr., Bibl. Enum. Born. Pl. 5: 514. 1921; Troup, Silvicult. Indian Trees 2: 776--777. 1921; Haines, Bot. Bihar Orissa, ed. 1, 4: 711. 1922; Ridl., Fl. Malay. Penins. 2: 632. 1923; S. Moore, Journ. Bot. Lond. 63: Suppl. 81. 1925; Janssonius, Mikrogr. Holz. 753, 754, 758, 762, 763, 766, & 811--819, fig. 295. 1926; Foxworthy, Malay. Forest. Rec. 3: 163--165. 1927; Heyne, Nutt. Plant. Ned. Ind., ed. 2, 1: 24 (1927) and 2: 1317--1318 (1927), and 3: 1646. 1927; Dop, Bull. Soc. Hist. Nat. Toulouse 57: 198, 208, 210, & 211. 1928; Gimlette, Malay Poisons 216. 1929; E. D. Merr., Univ. Calif. Publ. Bot. 15: 264. 1929; Burkill & Haniff, Gard. Bull. Straits Settl. 6: 235. 1930; Alston in Trimen, Handb. Fl. Ceyl.

6: Suppl. 232. 1931; Ali, Journ. Bombay Nat. Hist. Soc. 35: 603. 1932; Wangerin, Justs Bot. Jahresber. 56 (1): 669. 1936; Fletcher, Kew Bull. Misc. Inf. 1938: 405, 432, & 435. 1938; Alston, Kandy Fl. 64 & 65, fig. 347. 1938; Kanjilal & al., Fl. Assam 3: 479, 481, & 561. 1939; Savage, Cat. Linn. Herb. Lond. 110. 1945; M. R. Henderson, Malay. Nat. Journ. 6: 380. 1950; Janssonius, Key Javan. Woods 54 & 213, fig. 295. 1952; Pételot, Pl. Méd. Cambod. Laos Vietn. 2: [Archiv. Recherch. Agron. Past. Vietn. 18:] 250 (1953) and 4: 42, 52, 70, 171, 199, 257, 268, 277, & 289. 1954; Abeywickrama, Ceyl. Journ. Sci. Biol. 2: 217. 1959; Haines, Bot. Bihar Orissa, ed. 2, 2: 745--746. 1961; Satmoko in Wyatt-Smith & Wycherly, Nat. Conserv. W. Malays. Nat. Journ. Spec. Iss. 120. 1961; Willaman & Schubert, Agr. Res. Serv. U. S. Dept. Agr. Tech. Bull. 1234: 237. 1961; Mold., Résumé Suppl. 4: 13. 1952; Thwaites & Hook. f., Enum. Pl. Zeyl., imp. 2, 244. 1964; Backer & Bakh., Fl. Java 2: 606. 1965; Gaussen, Viart, Legris, & Labroue, Trav. Sect. Scient. Techn. Ind. Franç. Pond. Hors Ser. 5: 32, 39--42, 44, 46, 47, 49, & 50. 1965; Burkill, Dict. Econ. Prod. Malay Penins. 2: 1837, 2277, & 2280--2281. 1966; Douk, Trav. Lab. Mat. Méd.-pharm. Galen 50: 264. 1966; Raizada, Indian Forest. 92: 326. 1966; Anon., Ind. Bibliog. Bot. Trop. 4: 22. 1967; Douk, Ann. Pharm. Fr. 25: 165. 1967; Anon., Bull. Rubb. Res. Inst. Malaya 96: 78--90. 1968; Douk, Biores. Ind. 4: 5102. 1968; Gunawardena, Gen. Sp. Pl. Zeyl. 147. 1968; Hocking, Excerpt. Bot. A.13: 570. 1968; Hyland, U. S. Dept. Agr. Pl. Invent. 172: 98. 1968; Meijer, Bot. Bull. Herb. Forest Dept. Sabah 10: 223 & 224. 1968; Mold., Phytologia 17: 15, 17, 22--24, & 29. 1968; Mold., Résumé Suppl. 16: 12, 25, & 29 (1968) and 17: 6. 1968; Uphof, Dict. Econ. Pl., ed. 2, 545. 1968; Begemann, Lex. Nutzh. 4: 2211 (1969) and 5: 2631. 1969; Chan & Teo, Chem. Pharm. Bull. [Tokyo] 17: 1284--1286. 1969; Corner & Watanabe, Illustr. Guide Trop. Pl. 770. 1969; Keng, Ord. Fam. Malay. Seed Pl. 278, fig. 164. 1969; Mold., Biol. Abstr. 50: 418. 1969; Singh, Trop. Ecol. 10: 217. 1969; Agarwal, Wood-yield. Pl. India 67. 1970; Anon., Weed Abstr. 19: 29. 1970; Farnsworth, Pharmacog. Titles 5 (4): xii & item 3995. 1970; A. Robyns, Bull. Nattural. Belg. 51: 182, 186, & 188. 1970; Bhakuni & al., Indian Journ. Exp. Biol. 9: 91--102. 1971; Brandis, Indian Trees, imp. 2, 504. 1971; M. L. & M. M. Dhar, Dhawan, Gupta, & Srimal, Indian Journ. Exp. Biol. 9: 101. 1971; Farnsworth, Pharmacog. Titles 5, Cumul. Gen. Ind. 1971; Fonseka & Vinasithamby, Prov. List Local Names Flow. Pl. Ceyl. 35, 36, 54, 58, & 82. 1971; M. A. Martin, Introd. Ethnobot. Camb. 143, 195, & 196. 1971; Mold., Fifth Summ. 1: 131, 263, 269, 279, 282, 284, 285, 298, 303, 307, 318, 331, 374, & 390 (1971) and 2: 533, 602, 641, 713, 714, 716--720, 723, 726, 775, 780, 791, & 928. 1971; Roxb., Fl. Ind., ed. 2, imp. 3, 482--483. 1971; Mold., Phytologia 23: 423. 1972; Rollet, Bois For. Trop. 145: 34. 1972; Hegnauer, Chemotax. Pfl. 6: [Chem. Reihe 21:] 663, 678, & 679. 1973; Farnsworth, Pharmacog. Titles 8 (1): xvii. 1973; R. R. Rao, Stud. Flow. Pl. Mysore Dist. 2: 756 [thesis]. 1973; Gray & DeZeeuw, IAWA Bull. 1974 (2): 25, fig. 4. 1974; M. R. Henderson, Malay. Wild Fls. Dicot. 380. 1974; Mani, Ecol. Biogeogr. India [Illies, Monog. Biol. 23:] 200 & 772. 1974; Mold., Phy-

tologia 28: 445 & 446. 1974; Vivekanandan, Sri Lanka Forest., ser. 2, 11: 119, 125, 129, 135, 139, & 143. 1974; Roth, Nov. Pl. Sp., imp. 2, 317--318. 1975; Mold., Phytologia 31: 400, 407, & 412 (1975), 33: 375 (1976), and 34: 266. 1976; L., Fl. Zeyl., imp. 3, 195. 1976; Chin, Gard. Bull. Singapore 30: 196. 1977; Cramer, Sri Lanka Forest., ser. 2, 13: 14. 1977; Dittus, Biotropica 9: 282. 1977; Fundter & Wisse, Meded. Landbouwhogsch. Wagen. 77 (9): 205 & 206. 1977; W. Jack, Malay. Misc., imp. 2, 1 (1): 18--19 & opp. A. 1977; Mold., Phytologia 44: 225, 348, 352, 354, 360, 391, & 396 (1979), 45: 491 (1980), and 46: 20 & 21. 1980; Mold., Phytol. Mem. 2: 123, 252, 266, 269, 271, 274, 275, 288--290, 294, 298, 309, 319, 321, 367, 373, 412, 437, 457--459, & 593. 1980; Roxb., Hort. Beng., imp. 2, 46. 1980.

Additional & emended illustrations: N. L. Burman, Pl. Ind. pl. 43, [fig. 2]. 1768; Naves & Fern.-Villar in Blanco, Fl. Filip., ed. 3, 6: pl. 427 [in color]. 1878; Alston, Kandy Fl. fig. 347. 1938; Janssonius, Key Javan. Woods 213, fig. 295. 1962; Corner & Watanabe, Illustr. Guide Trop. Pl. 770. 1969; Keng, Ord. Fam. Malay. Seed Pl. 278, fig. 164. 1969; Gray & DeZeeuw, IAWA Bull. 1974 (2): fig. 4. 1974.

Recent collectors describe this species as a small or large timber tree, 4--20 m. [or "99 feet" acc. John], treelet, or shrub, 5 m. tall, the trunk 15--20 cm. in diameter at breast height and 1.35 m. [or "78 inches" acc. John] in circumference, buttressed, with a clear bole of 3--13 m., fluted, the buttresses to 1.5 m. high, 17.5 cm. thick, and 30 cm. long, the blaze yellow over tan, the outer bark light-brown or brown to brown-yellow, light-yellow, gray, grayish-white, or white, average in texture, hard or soft, smooth or scaly to slightly longitudinally fissured with wide brown fissures, 2--5 mm. thick, papery, laminated, the inner bark soft, 2--8 mm. thick, brownish-yellow or yellow, "pale-green and yellow near the cambium", mottled, laminated, the cambium yellow or whitish, the sapwood light-colored, "brown-pink" or "brownish-creamy" to yellow or white, the inner bark, cambium, and sapwood darkening on exposure, the heartwood light straw-color, very heavy, hard, the foliage massive and dark, the leaflets 3 or 5, often heavily infested with galls, the flower-clusters dense, the peduncles purplish-green, finely hairy, the inflorescence-axes brown or gray-green to gray or "yellowish and maroon-spotted", the flowers paniculate, the bracts yellowish, maroon-spotted, the calyx light- or gray-green to gray or tan or "yellowish and maroon spotted", finely hairy, 5-lobed, the tips dark-reddish, the stamens 4, filaments white, anthers black, and solitary pistil white, the immature fruit greenish or green to dark-green or greenish-yellow, globose, turning greenish-black or blackish to purple, dark-purple, purlish-black, or glossy black when ripe, hard, juicy, 12.5 mm. long and wide.

The corollas are described by these same recent collectors as "white" on *Herb. N. Born. For. Dept. A.283* and *King 5499*, "bluish-white" on *Larsen & al. 30645*, "white, lip blue" on *Maxwell 75-861*, "greenish-white with bluish upper lip" on *Beusekom & Phengklai 651*, "yellowish-white" on *Cuadra A.1160*, "whitish" on *Herb. N. Born.*

For. Dept. A.360, "violet-white" on *Herb. N. Born. For. Dept. A. 1297*, "lavender & white" on *Stone 10874*, "with 4 white petals & 1 purple" on *Hardial & Sidek 499* and *Luang S.24531*, "pink" on *Herb. N. Born. For. Dept. A.23*, "pinkish" on *Niyomdhan & al. 204*, "purplish" on *Flenley 64* and *Fosberg 43803*, "purple" on *Ante 1211*, "mauve" on *Gibbs 3012*, "lilac" on *Sinclair 5239*, "blue" on *Khoo & Ming NK.4* and *Herb. N. Born. For. Dept. A.1405*, "pale-blue" on *SAN.18471*, "light-blue" on *Geesink & Santisuk 4994* and *Tan SAR. 28913*, "violet-blue" on *Cheok s.n.*, "lavender to dirty-white" on *King 5422*, "light-blue, yellow at base" on *Kames & al. s.n.*, "light-violet" on *Herb. N. Born. For. Dept. A.55*, "tube light yellowish-tan, lobes whitish with a light-blue hue" on *Maxwell 76-737*, "pale-lavender saccate lip. other petals whitish with a lavender tinge" on *Stone 5762*, "pale-purplish" on *Cuadra A.2469*, "purplish-white" on *SAN.20918*, "greenish-red" on *Herb. N. Born. For. Dept. A.2524*, "light yellowish-white" on *Herb. N. Born. For. Dept. A.1496*, "greenish-yellow" on *Cuadra A.2499, 3179, & 3186*, "yellow" on *Bakar 18570*,and *Herb. N. Born. For. Dept. 10168*, "light-yellow" on *Cuadra A.1063*, "green" on *Chai 25150*, "light yellowish-cream outside, blue inside" on *Maxwell 76-565*, and "yellow-green outside, 4 lobes whitish inside, larger lobe blue" on *Maxwell 76-357*.

Recent collectors have found this plant growing in primary and secondary forests, secondary jungles, swampy and evergreen forests, low depauperate shrubby or undergrowth forests, disturbed primary forests, and open sandy dry dipterocarp forests with sandstone boulders, in open sandy thickets, old clearings with much bamboo, open rocky riverine areas, open grassy places in back of beaches, and in "grassland near edge of water", in low undulating country and swampy land, on low hills and hillsides, lake shores and on or near seashores, on flat land and on disturbed open rocky slopes with mostly dry deciduous forest, along roadsides, railroad tracks, and riverbanks, at the edges of forests and of lalong (*Imperata cylindrica*) fields, in sandy and wet sandy soil as well as red, rocky, mineral, and sandstone soil, often in the open sunlight, at altitudes of sealevel to 600 m., in flower and fruit in every month of the year. King reports encountering it in "cutover pastures at base of hills with shrubs and trees to 30 m. tall, soil a thin dark clay over limestone" in Thailand.

Poilane reports that the species furnishes a good wood not attacked by termites and "employé pour colonne; in sol argilo sableu couvert de brousse qui a remplacé la forêt detruits". Stone asserts that the strong wood is used to make handles; Cuadra says that the wood is used to some extent to make the handles for better-class cutting weapons, also for posts and general construction, and that it is much in demand for boat paddles and plowing equipment. Togashi reports it a common tree in Singapore, while Ripley also found it a common tree on sandy soil in Sri Lanka. *Ripley 246* serves as voucher for primate ecology studies in Sri Lanka. Pollen samples were taken from *Flenley 64*. *Kasim bin Rajah s.n.* consists of seedlings 23, 38, and 60 days old respectively. *Cheok s.n.* represents the strictly trifoliolate form of

the species. Wood samples accompany *King 5422 & 5499*, while wood samples are also deposited in the U. S. Nat. Mus. Sect. of Wood Technology from *Krukoff 314*.

In regard to my acceptance of Linnaeus' name, *Vitex pinnata*, Dr. F. R. Fosberg has reviewed my argument in Phytologia 6: 70--71 (1957) and writes: "I see no reason for any change from *V. pinnata* L. inappropriate as that name may be for a palmately compound-leafed species". In a letter to me, dated December 8, 1976, he says: "The Flora Zeylanica was based very largely on the Hermann herbarium and Thesaurus. I know of 2 sets of Hermann specimens, one at British Museum and one at Leiden. I think the BM one is best and usually used to typify species in Species Plantarum based primarily on Flora Zeylanica references. There is nothing in the Code on typification of these species particularly. It is generally agreed, I think, that if there is an asterisk by a reference in Species Plantarum that it is the principal basis of Linnaeus' description. There are such asterisks with many Flora Zeylanica references. I have usually given considerable weight to Flora Zeylanica references, even without the asterisk, as Linnaeus had actually seen and studied the Hermann collection, but there is no set rule."

It is of interest to note that Linnaeus, in the 1753 edition of his Species Plantarum, describes this species as "VITEX foliis pinnatis, paniculis trichotomis", while in the 1763 edition he says "foliis pinnatis integerrimis, paniculis trichotomis", adding one descriptive adjective. In both cases he cites the *Pistacio-vitex* from his Flora Zeylanica.

It is also of interest to note that in N. L. Burman's Flora Indica (1768) the "fig. 2" on pl. 43 is supposed to represent "*Vites* [sic!] *pinnata*" but actually represents part of the *Ovieda mitis* [=*Clerodendrum indicum* (L.) Kuntze]. What was apparently intended to be labeled fig. 2, on the top part of the plate, is unnumbered and it represents *Aglaia odorata* Lour. In the text the binomial is correctly spelled "*Vitex pinnata*", but the generic name is misspelled on the plate. The text reads: "Tab. 43. f. 2. VITEX (pinnata) foliis pinnatis integerrimis, paniculis trichotomis. Linn. Sp. 890. Pistacio-vitex. Linn. Fl. zeyl. 445. Patjar China. Cambang Ysjulang malaice dicta Javanis. Habitat in Java & Zeylona". Raeuschel (1797) credits *Vitex pinnata* only to "India", while he attributes *Vitex pubescens* to "India orient." Moon (1821) also kept the two taxa separate and regarded both as native to Sri Lanka. Loudon (1832) asserts that what he calls *Vitex latifolia* and *V. arborea* were both introduced into cultivation in England in 1820 from "E. Indies". but G. Don (1839), while giving the same date of introduction, claims that the latter plant came from Nepal.

Spach (1840) tells us that "Cet arbre croît dans les montagnes de l'Inde; son vieux bois est couleur de chocolat, très-solide et durable, ce qui le rend prope à quantité d'usages". Jack (1843) says "The wood of this tree is very hard, and is employed by the inhabitants of Sumatra in the construction of houses. They consider an infusion of the bark as a useful application in cases of

ophthalmia." Corner & Watanabe (1966) also describe it as "medicinal", calling it a "Tree of secondary forests", the corollas violet-blue, and the fruit purple to black.

Dietrich (1843) described *Vitex latifolia* Lam. and *V. arborea* Roxb., as well as his *Wallrothia articulata*, from "Ind. or." [meaning eastern India or the East Indies?], reducing *V. pubescens* Vahl with a question to synonymy under *V. latifolia,* and *V. digitata* Wight and "*V. tomentosa* hb. Madr." to *V. arborea*. Voigt (1845) reports *V. arborea* Roxb. cultivated in suburban Calcutta in that time. Alston (1931) found it cultivated at Peradeniya, Sri Lanka.

Clarke (1885) asserts that the species is frequent in the southern Deccan Peninsula [of India] and Sri Lanka, also in "E. Bengal and Malay Peninsula, from the Khasia Terai....to Singapore: frequent from Pegu southwards. -- Distrib. Throughout Malaya", citing only an unnumbered Hooker & Thomson collection from Khasia. Fernandez-Villar (1880) reports it from Luzon and Guimaras islands in the Philippines. Prain (1903) describes it as a tree "30--50 feet high", listing it from "E. Bengal [=Bangladesh]; Tippera; Chittagong".

Troup (1921) gives a very interesting discussion of the species: "A moderate-sized to large tree with quadrangular branchlets and 3- or 5-foliate leaves. Wood very hard and close-grained, durable and useful. Forests of southern India, extending north on the east side to Orissa; Sylhet, Burma in upper mixed deciduous forests, Andemans. In southern India it is common chiefly along the banks of streams. Growth, according to Gamble, 8 to 10 rings per inch of radius, giving a mean annual girth increment of 0.63 to 0.78 in.

"A tree referred to by Mr. A. Rodger [1900] under the name of 'kyungauknwè' in the forests of the Ruby Mines district, Upper Burma, perhaps belong to this species. He describes it as occurring on fertile slopes along with well-grown teak, *Xylia dolabriformis, Terminalia tomentosa, Pterocarpus macrocarpus, Anogeissus acuminata, Pentacme suavis,* and other species, as well as various bamboos; also in dry stunted forest on poor shallow soil with *Diospyros burmanica, Terminalia oliveri,* and the species already mentioned, teak being very scarce and of small size and the chief bamboo being *Dendrocalamus strictus*.

"Mr. G. R. Jeffert [1909] refers to this tree in the same district in the following words: 'Allied to teak and possessing many of the properties of teak, durable, light (floating in fresh water), even-grained but rarely attains sufficient dimensions or number to be worth extracting. Has a decided demand in Mandalay, which would be much greater were a regular supply obtainable. The tree has the appearance of a very slow growth and reproduction does not seem good.'"

Merrill (1929), citing *Elmer 20101* & *21095,* refers to it as "A small tree everywhere in low altitude forests [of Borneo], the flowers white to very pale bluish. India to Indo-China, through Malaysia to Java, Celebes, Timor, and the western part of the Philippine group." In his 1923 work he lists the species from the islands of Balabac, Culion, Guimaras, Jolo, Mindoro, Palawan, and Tawitawi in the

Philippines, and notes that "In the islands mentioned [it is] common in once cleared areas, and secondary forests at low altitudes", giving the overall distribution also as "India to Indo-China, Malay Peninsula, Borneo, Java, Timor, and Celebes". Janssonius (1926) gives a detailed description of the wood anatomy.

Alston (1931) uses the name, *Vitex pubescens* Vahl, for this species and mis-applies the name, *V. pinnata* L., to what actually is *V. altissima* L. f. and in this he is followed by some other recent authors such as Abeywickrama (1959). Alston suggests that the tree cultivated in the Botanical Garden at Peradeniya "was probably the source of *Walker 1122*" in the Peradeniya herbarium.

Crevost & Pételot (1934) report the species from Cochinchina and Cambodia and assert that "les graines sont prétendues vermifuges et dont l'ecorce (ou les feuilles) ont la réputation d'activer la pousse des cheveux et de la barbe". Ali (1932) avers that the flowers are "bird-visited [ornithophilous]" Pételot (1953) notes that the "Espece très commune dans tout le Sud-indochinois, n'existant pas au Nord-Vietnam.....les racines en infusion sont utilisées au Cambodge pour calmer les coliques des enfants en bas âge. A Sumatra, le liquide obtenu par l'écrasement des jeunes feuilles est bu dans les cas d'inappétence ou de tendance à la fièvre. Gimlette.....rapporte que l'odeur dégagée par la plante quand elle brûle est utilisée par les voleurs pour empêcher de percevoir l'odeur du *Datura* qui en brûlant dégagé une fumée qui stupéfie les vistimes." Burkill (1966) calls it "A tree of fair size, found throughout south-eastern Asia and Malaysia; in the [Malay] Peninsula it is the commonest species of the genus, both in open country and in secondary jungle. It often persists in lalang, and will grow in rather poor soil if it has full light. It has been mentioned as possibly useful for reclothing old tin workings. There are several forms of the tree more or less distinguished by those most familiar with it.....The timber seems to be commercial in the Philippine Islands, along with that of *V. parviflora*, Juss., under the name 'molave'.....and it is the lĕban wood most used in the Malay Peninsula.

"Foxworthy writes of it: 'The tree is of small size and often has a short crooked trunk, so that it is not possible to get long timbers. The wood is hard, heavy, fine-grained with no disjunction between the sap-wood and the heart-wood, yellow, greyish, or olive-coloured, very durable in contact with the ground. It is the most in demand of any wood for the manufacture of Malay ploughs and other agricultural implements. The wood from young trees is not durable, and trees should be allowed to reach a girth of three feet before they are cut. This wood would be much more widely used for heavy construction if it could be had in larger sizes, indeed, it has been mentioned as used in bridges, for house-posts, and also for boats.....The leaves and bark are medicinal. The Malays make a decoction of the bark and drink it for stomach-ache and as.....a protective draught taken after childbirth. The leaves are used for poulticing both in fevers and for wounds....In Sumatra it is said that scrapings of the bark

may be applied to wounds. The young leaves are crushed in water, which is drunk when there is loss of appetite and a tendency to fever....Heyne says that he was told that the fruit is medicinal. Boorsma found an extract to froth, but not from the presence of saponin.....De Clercq says that the Bataks drink such an extract. .....To the plant is assigned a protective power, and so it is used as a charm against convulsions.'" He also affirms that the wood of the larger species of *Premna* is similar to that of this species, but is much less dense and inferior in its durability. Begemann (1969) gives a detailed description of the wood and its uses.

Satmoko (1961) tells us that *Vitex pinnata* is found among the lowland trees in the forests of the interior of Java, while Singh (1969) says that it is common in dry semi-evergreen forests of India. Agarwal (1970) gives its natural distribution as "Orissa, in East Pakistan [=Bangladesh], Burma, Andamans & South India", describing the wood as "smooth, grey with olive brown tinge or reddish, very hard, close grained & durable; Wt. 22.90 kgms to 24.10 kgms/cft. Used for making axe handles in South India". Martin (1971), giving its distribution as Cambodia, Laos, Vietnam, Thailand, Malaysia, Burma, India, and Ceylon, reports that "L'écorse est employée pour préparer une tisant fortifiante", that it is medicinal, and that the "plants fournissant un bois-d'oeuvre". Uphof (1968) also describes the wood as "hard, heavy, durable, fine-grained, yellow-brown to dark-brown, used for household goods, plows, handles of tools, furniture, building of houses". Cramer (1977) asserts that in Sri Lanka it has "medium timber volume per acre".

Meijer (1968) affirms that "The tree is a good host to wild orchids. The leafless orchid *Taeniophyllum* was found on it..... The tree is probably the best known among the locals [in Sabah] and it produces the hardest and most durable timber of all our belukar timbers."

Hyland (1968) lists it as cultivated in Maryland [U. S. Dept. Agr. Pl. Inv. 297318] from seed imported from Guyana. Dalla Torre (1917) reports on the leaf-galls often found on the vegetative parts.

It is worth mentioning here that the Blume (1826) reference in the bibliography of this species is sometimes cited erroneously as volume "9" and dated "1825". In the Wight (1849) work one finds the name "*Vitex pubescens* (Vahl) Schau." used in the text and *V. arborea* Roxb. on the illustrative plate. The "*Vitex bracteata* Miq." of Pételot (1954) is cited in the Index Kewensis as "Herb. Horsf. ex Miq., Fl. Ind. Bat. 2: 862." The Moore (1925) reference is often ascribed to Rendle or to "S. Moore in Rendle", but it appears to have been authored by Moore alone. Sinclair, as well as Corner & Watanabe (1969) erroneously describe the drupaceous fruit as "berries". The *Anonyma* Plum. ex L., Hort. Cliff. 319 (1737), referred to in the synonymy (above), is a synonym of *Petrea kohautiana* Presl. The vernacular names reported for "*Vitex pinnata*" by Fonseka & Vinasithamby (1971) and by Vivekanandan (1974) from Sri Lanka, actually apply, instead, to *V. altissima* L.f.

Among the common and vernacular name reported by recent collectors and authors as applying to the true *Vitex pinnata* may be mentioned the following: "ahoi", "alóban-bátu", "alobanbúnga", "aoal", "arekodol", "bandegiri", "bhadruk", "bhodia", "binh linh nghê", "boosi", "broad-leaved chaste-tree", "cay binh linh", "cay nang", "dɑ̀m pɔ̀pu:l thɔ̀:", "dieng-lakhiet-dkhar", "dok timouk", "gattilier élancé", "halban", "hamolauon", "kajoe aloban", "kajoe gijak", "kajoe laban", "kulimpapa", "kulimpapa batu", "kulimpapa simpor", "kulimpapa sinpor", "kulumpapa", "kyetyo", "laban", "leban", "lebau", "lubbun", "Malayan teak", "milla", "miong-greng-phang", "myladi", "muria", "nemali adugu", "pinnate chaste-tree", "popoul romiet", "popoul thnar", "pubescent chaste-tree", "thang-thang-arong", "trasek", "tree chaste-tree", and "xo-nang".

Heyne (1917) gives a lengthy and detailed description of the 4 types of this tree distinguished commercially by wood characters and also a detailed list of actual and purported uses of the bark, leaves, and fruit in medicine, pharmacy, local economy, and folklore.

Hallier (1918) cites *Hallier B.790, B.903,* & *B.926* from western Kalimantan, *Korthals 26* and 3 unnumbered collections and *Winkler 2156, 2179,* & *2579* from southeastern Kalimantan, *Elbert 2982* from Celebes, and *Elbert 4677* from Wetar, as well as *Beccari 763, Forbes 2572, Van Daalen 478,* and unnumbered collections of Junghuhn, Korthals, and Praetorius from Sumatra, *Van Rossum 11* from Billiton, *Zollinger 229* and unnumbered collections of Blume, Boerlage, Junghuhn, Korthals, and Kuhl & Van Hasselt from Java, Zippelius from Timor, DeVriese & Teijsmann from Ceram, Reinwardt from Nusah Laut, DeVriese from Halmahera, *Villar 487* Iloh-iloh, and *Fénix 15649* from Culión.

Fletcher (1938) cites from Thailand: *Annandale 1667, Collins 167* & *186, Fox 3828, Kerr 2039, 4455, 6893, 7491, 10885, 11389, 13875,* & *17085, Kloss 6607, Lakshnakara 611, Marcan 2281, Put 304, 834, 1258,* & *4273, Rabil 21, 80,* & *243, Ridley 14938,* and *Vanpruk 607.* He gives its overall distribution as "S. India (type), Burma, Assam, French Indo-China, Malaya."

Dop (1928) cites the following collections from Indochina: Annam: *Lecomte & Finet s.n., Poilane 6843, 8171,* & *s.n.* [Bangoi]. Cambodia: *Chatillon s.n.* [Réserve de Phtuol], *Godefroy 686. Pierre s.n.* [Phu Quoc], *Poilane 423, Spire 224,* & *Thorel s.n.* [Oudon]. Cochinchina: *Godefroy 678, Lefevre 388* and *Pierre 645, 2224,* & *5216.* Laos: *Harmand 197, Poilane 11399,* and *Thorel 1004.* He also cites *Schomburgk s.n.* from Thailand and records the species from Condor Island, Cochinchina.

Material of *Vitex pinnata* has been misidentified and distributed in some herbaria as *Glossocarya mollis* Wall. and as *Vitex limonifolia* Wall. On the other hand, the *Amaratunga 175, 268,* & *1023, Cooray 69111730R, Cramer 4366, Dittus WD.69102302, Hladik 855, Mueller-Dombois 67081404, Mueller-Dombois & Comanor 67072507* & *67072528, Ripley 78, 135, 189,* & *247, Sohmer 8210, Waas 1267,* and *Worthington s.n.* [Kandy, Oct. 24, 1957], distributed as *V. pinnata,* actually are *V. altissima* L.f., while *Fosberg & Ripley 51942* is *V. altissima* f. juv. *alata* (Willd.) Mold., *Amaratunga 1343, Balakrish-*

nan & Jayasuriya NBK.886, Kostermans 24109, Meijer 412, Mueller-Dombois 68102114, Sohmer, Jayasuriya, & Eliezer 8271, and *Waas & Peeris 540a* are *V. altissima* f. *subglabra* Thwaites, *R. M. King 5493* is *V. canescens* Kurz, *Binideh 63159* is *V. parviflora* A. L. Juss., *Gibot 46480* is *V. quinata* (Lour.) F. N. Will., and *Chai SAN.26696* & *26903* are *V. secundiflora* var. *longipes* Mold. *Tan SAR.28913* is a mixture with something non-verbenaceous.

Additional citations: INDIA: Assam: *Hooker & Thomson s.n.* [Mont. Khasia] (Mu--673); *Jenkins s.n.* (Pd). SRI LANKA: *Herb. Hermann 1: 16* [lower left] (Bm--type, Z--photo of type); *Ripley 246* (W--2884424). BANGLADESH: *King's Collector 585* (Pd); *Majumder & Islam 24537* [120] (Ws, Ws); *Wallich 1747/2* (Mu--1460, Pd). BURMA: Tenasserim: *Falconer 503* (Pd). ANDAMAN ISLANDS: *Helfer 6060* (Mu--638, Pd). MERGUI ARCHIPELAGO: Mergui: *Griffith 46* (Pd). THAILAND: *Beusekom & Phengklai 651* (Ac), *2781* (Ac); *Collins 186* (Ac); *Geesink & Santisuk 4992* (Ac); *Kerr 11132* (Ac), *11389* (Ac); *R. M. King 5422* (W--2435987), *5499* (W--2435871, W--photo, W--photo); *Larsen, Larsen, Nielsen, & Santisuk 30645* (Ac); *Maxwell 71-273* (Ac), *71-401* (Ac), *73-377* (Ac), *73-518* (Ac), *73-686* (Ac), *75-861* (Ac), *76-357* (Ac), *76-565* (Ac); *Murata, Fukuoka, & Phengklai T.17627* (Ac); *Niyomdham, Sangkachand, & Vijitranand 204* (Ac); *Put 894* (Ac); *Rabil 21* (Ac), *243* (Ac). INDOCHINA: Annam: *Poilane 6259* (Ac), *6843* (Ac). MALAYA: Pahang: *Flenley 64* (Kl--13822); *B. C. Stone 10874* (Kl--16784). Selangor: *Cheok s.n.* [2 July 1965] (Kl--5851); *Hardial & Sidek 499* (N); *B. C. Stone 5762* (Kl--4556), *L.24* (Ne--22953, Ne--33954). Singapore: *Maxwell 76-737* (Ac); *Sinclair 5239* (W--2913180); *Togashi 6211521* (Ac). Trengganu: *"A. J." 4079* (Kl--7665), *4107* (Kl--7631). State undetermined: *Khoo & Ming N.K.004* [Cape Eschado] (Kl--8642). PHILIPPINE ISLANDS: Balabac: *Mangubat s.n.* [Herb. Philip. Bur. Sci. 482] (W--439698). Culión: *Fénix s.n.* [Herb. Philip. Bur. Sci. 15649] (W--714961); *E. D. Merrill 451* (W--435421), *502* (W--435472). Guimaras: *Gammill s.n.* [Herb. Philip. Forest. Bur. 273] (W--852354). Mindoro: *Ebalo 327* (Mi). Palawan: *Bermejos s.n.* [Herb. Philip. Bur. Sci. 189] (W--439313); *Danao s.n.* [Herb. Philip. Forest. Bur. 19903] (W--902382); *Edaño s.n.* [Philip. Nat. Herb. 13999] (W--2125805), *s.n.* [Philip. Nat. Herb. 14186] (W--2376247); *Elmer 12660* (W--873092), *13004* (W--873090); *Fernandez s.n.* [Herb. Philip. Forest. Bur. 21484] (W--903473); *Foxworthy s.n.* [Herb. Philip. Bur. Sci. 762] (W--627070); *Natividad s.n.* [Herb. Philip. Forest. Bur. 23350] (W--1376029). GREATER SUNDA ISLANDS: Bangko: *Ante 1211* (Ba). Gaya: *Kanis & Kuripin 56136* (Ld); Java: *Collector undetermined s.n.* (Pd); *Koorders 9790* (Pd), *9804b* (Pd); *Zollinger 229* (Pd). Kalimantan: *Kostermans 21243* (E-1830232). Sabah: *Academia SAN.34460* (Ld); *Apastol s.n.* [Herb. N. Born. Forest. Dept. A.55] (W--2317070); *Bakar 18570* (Ld); *Cuadra A.1063* (W--2187447), *A.1160* (W--2210850), *A.2499* (W--2188644), *A.3179* (Kl--8824), *A.3186* (W--2129120, *s.n.* [Herb. N. Born. Forest. Dept. A. 1297] (W--2210737), *s.n.* [Herb. N. Born. Forest. Dept. A.1405] (W--2317060), *s.n.* [Herb. N. Born. Forest. Dept. A.1496] (W--2317114); *Elmer 20101* (Mi, Mu), *21095* (Mi, Mu); *Enggoh s.n.* [Herb. N. Born. Forest. Dept. 10168] (W--2187132); *Gibbs 3012* ["3132"] (W--2334201);

Hepburn SAN.18471 (Ld); *Herb. N. Born. Forest. Dept. 3099* (K1--17556); *James en Wing s.n.* [Herb. N. Born. Forest. Dept. A.283] (K1--17415, W--2156048); *John s.n.* [Herb. N. Born. Forest. Dept. A.617] (W--2187087); *Kadir s.n.* [Herb. N. Born. Forest. Dept. A.23] (K1--17394, W--2317066), *s.n.* [Herb. N. Born. Forest. Dept. A.360] (W--2317098), *s.n.* [Herb. N. Born. Forest. Dept. A.2524] (W--2210683); *Meijer & Bisset 42979* (Ld); *Sales 3906* (Pd); *Sam A.2953* (K1); *Singh SAN.20918* (Ld). Sarawak: *Brooke 8099* (W--2319572); *Carrick & Enoch JC.190* (K1--3177); *F. R. Fosberg 43803* (W--2638855, W--2638876); *Foxworthy 11* (W--713213); *Kames & al. s.n.* [Herb. Sarawak Forest. Dept. S.34606] (Ld); *Luang S.24531* (N); *Tan SAR.28913* (Ft--11328, Ln--232016, Ln); *Wasli S.2* (K1--17875). Selingan: *Cuadra A.2469* (W--2188640). Sepangar: *Sinanggul SAN.40109* (Ld). Sumatra: *H. H. Bartlett 8738* (W--1553018); *Bartlett & LaRue 351* (W--1053948); *Herb. Neth. Ind. Forest. Serv. bb.29440* (N); *Krukoff 314* (W--1702615), *335* (W--1702636), *4337* (W--1750717); *Toroes 1580* (W--1680122), *2367* (W--1861014), *4190* (W--1680814); *Yates 1267* (Pd). Tabawan: *Chai 26150* (Ld). CULTIVATED: India: *Herb. Hort. Bot. Calcut. s.n.* (Pd). Java: *Herb. Hort. Bot. Bogor. 509* (W--651362); *Kostermans 11084* [Herb. Hort. Bot. Bogor. XI.I.46a] (N). Malaya: *Kasim bin Rajab s.n.* (K1--1756). Sri Lanka: *Foreman s.n.* [Royal Bot. Gard. Peradeniya, 7 July 1911] (Pd, Pd, Pd); *H. A. Parsons 344* (K, Pd). MOUNTED DESCRIPTIONS: Turcz., Bull. Soc. Nat. Mosc. 36: 223 (W).

VITEX PINNATA var. *ALATA* Mold.

This taxon is now known as *Vitex pinnata* f. *ptilota* (Dop) Mold., which see.

VITEX PINNATA f. *ANOMALA* Mold.

Additional bibliography: Mold., Phytologia 17: 24. 1968; Mold., Fifth Summ. 1: 331 (1971) and 2: 928. 1971; Mold., Phytol. Mem. 2: 321 & 593. 1980.

VITEX PINNATA f. *GLABRESCENS* Mold., Phytologia 33: 375. 1976.

Bibliography: Mold., Phytologia 33: 375 (1976) and 34: 266. 1976; Mold., Phytol. Mem. 2: 298 & 593. 1980.

Citations: MALAYA: Selangor: *Kasim bin Rajab 91* (Ac--photo of type, K1--1091--type, N--photo of type, Z--photo of type).

VITEX PINNATA var. *PANTJARENSIS* (Hochr.) Mold.

Bibliography: Hochr., Candollea 5: 191--192. 1934; Mold., Phytologia 17: 24. 1968; Mold., Biol. Abstr. 50: 418. 1969; Mold., Résumé Suppl. 16: 12. 1968; Mold., Fifth Summ. 1: 328 (1971) and 2: 726 & 928. 1971; Mold., Phytol. Mem. 2: 319 & 593. 1980.

VITEX PINNATA f. *PTILOTA* (Dop) Mold., Phytologia 49: 432. 1981.

Synonymy: *Vitex pubescens* var. *ptilota* Dop, Bull. Soc. Hist. Nat. Toulouse 57 (2): 198--199, pl. 2. 1928. *Vitex pinnata* var. *alata* Mold., Phytologia 3: 120. 1949.

Bibliography: Dop, Bull. Soc. Hist. Nat. Toulouse 57 (2): 198--199 & 211, pl. 2. 1928; Wangerin, Justs Bot. Jahresber. 56

(1): 669. 1936; Fedde & Schust., Justs Bot. Jahresber. 56 (2): 286. 1937; Mold., Phytologia 3: 120. 1949; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 137 & 202. 1949; Mold., Phytologia 6: 79. 1957; Mold., Résumé 177, 191, 423, & 478. 1959; Mold., Phytologia 8: 75 (1961), 15: 324 & 325 (1967), and 17: 24. 1968; Hocking, Excerpt. Bot. A.13: 570. 1968; Mold., Biol. Abstr. 49: 851. 1968; Mold., Fifth Summ. 1: 303 & 328 (1971) and 2: 791 & 928. 1971; Mold., Phytol. Mem. 2: 288, 289, 294, 319, & 583. 1980; Mold., Phytologia 49: 432. 1981.

Illustrations: Dop, Bull. Soc. Hist. Not. Toulouse 57 (2): pl. 2. 1928.

This form is based on *Lecomte & Finet 1417*, collected between Phan Rang and Tourchan, and *Poilane 5* & *21* from Bangoi, Annam, Vietnam. Dop (128) comments that "La plupart des auteurs, indépendamment d'autres caractères, distinguent les deux espèces précédentes [*V. limonifolia* and *V. pubescens*] par l'absence ou la présence d'une aile au pétiole. *V. pubescens* a le pétiole non ailé, *V. limonifolia* a au contraire un pétiole largement ailé. Ce dernier caractère, dans *V. limonifolia,* est constant; par contre, il m'a paru être un caractère fluctuant dans *V. pubescens.* La plupart des échantillons que j'ai examinés sont nettement dépourvus d'aile pétiolaire; cependant, comme Kurz (Flora British Burma, II, 271) l'a signalé, le pétiole de *V. pubescens* peut présenter à son sommet une aile étroite. Cette aile est particulièrement nette dans les individus récoltés par Pierre à Phu Quoc et à PouloCondor, tellement qu'à un simple examen superficiel ce botaniste avait nommé dans son herbier les *V. pubescens* de ces îles *V. limonifolia.* Sur ces échantillons, la largeur de l'aile pétiolaire atteint les dimensions suivantes: 2, 4, 6 et 8 mm. Dans les formes annamites, j'ai observé un développement encore plus grand de l'aile pétiolaire de *V. pubescens.* Les échantillons récoltés de Phan rang à Tourchan par MM. Lecomte et Finet, ont une aile de 6 a 8 mm. de largeur qui se développe non plus seulement au sommet mais sur toute la longueur du pétiole et dans les échantillons récoltés par M. Poilane à Bangoi, j'ai mesuré les largeurs d'aile suivant: 6, 10, 12, 20, 28 mm., avec une forme arrondie ou cordée au sommet, aiguë ou tronquée à la base. C'est pour ces échantillons à pétiole largement ailée que j'ai créé la variété *ptilota.* Par tous les autres caractères, forme de inflorescence, structure de la fleur, villosité de l'ovaire, ces formes à pétiole plus ou moins ailé se rattachent incontestablement au *V. pubescens.* Dans la distinction de cette espèce du *V. limonifolia,* les caractères tirés de l'alature du pétiole ne peuvent donc être utilisés."

Recent collectors describe this plant as a tree, 10--15 m. tall, and have found it growing in mixed deciduous dipterocarp forests, at 300--400 m. altitude, in anthesis in August.

Additional citations: THAILAND: *Larsen, Larsen, Nielsen, Santisuk 31756* (Ac, Z).

VITEX POGGEI Gürke

Additional & emended bibliography: J. G. Baker in Thiselt.-Dyer,

Fl. Trop. Afr. 5: 317 & 329. 1900; Mold., Phytologia 17: 24. 1968; Mold., Fifth Summ. 1: 232 (1971) and 2: 928. 1971; Mold., Phytol. Mem. 2: 221 & 593. 1980.

Baker (1900) cites only the type collection, *Pogge 1255*, from tropical west Africa.

VITEX POLYGAMA Cham.

Additional synonymy: *Vitex gartnerii* Cuatresasas & Duarte ex Mold., Fifth Summ. 2: 717, in syn. 1971.

Additional bibliography: D. Dietr., Syn. Pl. 3: 612. 1843; Buek, Gen. Spec. Syn. Candoll. 3: 86 & 501--502. 1858; C. Muell. in Walp., Ann. Bot. Syst. 5: 712. 1860; Benth. in Benth. & Hook. f., Gen. Pl. 2 (2): 1154. 1876; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 172. 1895; Huber, Arboret. Amaz. 22. 1900; Peckolt, Bericht. Deutsch. Pharm. Gesel. 14: 482. 1904; H. N. & A. L. Mold., Pl. Life 2: 49, 57, 61, & 88. 1948; Rizzini in Ferré, Simpos. Cerrado 116. 1962; Angely, Fl. Anal. Paran., ed. 1, 580. 1965; Mold., Phytologia 17: 24--26. 1968; Mold., Résumé Suppl. 17: 13. 1968; Angely, Fl. Anal. Fitogeogr. Est. S. Paulo, ed. 1, 4: 828 & xix. 1971; Mold., Fifth Summ. 1: 179, 180, 374, & 423 (1971) and 2: 531, 709, 717, 720, 724, 726, 728, & 928--929. 1971; Heiseke & Lamas, Bras. Florest. 5 (18): 8. 1974; Troncoso, Farwiniana 18: 395 & 412. 1974; Ratter, Askew, Montgomery, & Gifford, Revist. Bras. Bot. 1: 51. 1978; Reitz, Klein, & Reis, Proj. Madeira S. Catar. 42. 1978; Kummrow, Bol. Mus. Bot. Munic. 38: 14. 1979; Troncoso in Burkart, Fl. Ilustr. Entre Rios 5: 292. 1979; Mold., Phytol. Mem. 2: 171, 172, 367, & 593. 1980.

Recent collectors refer to this plant as a shrub or subshrub, 0.6--2 m. tall, or a small slender tree, to 4 m. tall, with many stems, the trunks 4--7 cm. in diameter at breast height, the leaves 3- or 5-foliolate, the calyx brownish-green, the anthers red, the pollen white, and the fruit at first green, then dark wine-color, maturing black. They have encountered it in capão, on outcrops in rocky cerrado, in sunny restinga, and on talus slopes below cliffs, at altitudes of sealevel to 1450 m., in anthesis in February and November, and in fruit from January to March. Huber (1900) asserts that it is a characteristic plant of the campo cerrado.

The corollas are said to have been "blue" on *Hatschbach & Kasper 41705*, "white or lilac" on *Cuatrecasas & Duarte 26639*, "violet with the tube lighter" on *Mattos & Mattos 8382*, "white with a lavender lip" on *Anderson 11638*, and "white with the tips of the lobes blue" on *Hoehne 5905*.

Additional vernacular names reported for the species are "Maria preto" and "tarumã tuira". Heiseke & Lamas (1974) aver that it grows in association with much *Araucaria angustifolia, Pinus elliottii*, and *P. taeda*. Angely (1971) calls it a hylophyte, growing from 800--1100 m. altitude in São Paulo, Brazil, fruiting there in December; he lists it also from Guanabara, Minas Gerais, Rio de Janeiro, Paraná, and Santa Catarina. His publication, cited above, is sometimes cited by the erroneous titlepage date of "1970".

Mueller (1860) differentiates Schauer's (1847) two varieties as

follows:
Var. *holosericea* -- "pube communi velutino-tomentosa" [this is the typical variety]
Var. *hirsuta* -- "pube communi villoso-hirsuta".

Peckolt (1904) says of *V. polygama:* "In den Staaten Espirito Santo, Minas, S. Paulo und Rio de Janeiro vorkommend, ebenfals Tarúma -- Ölfruchtbaum benannt, auch Paó molle -- Weiches Holz, am häufigsten Maria preta -- Schwarze Marienfrucht. Ein 9 m hoher Baum mit wohlschmeckenden, saftigen, schwarzen Steinfrüchten von der Grösse einer Herzkirsche. Das weiche weisse Holz dient zu Schnitzarbeiten. Nach Dr. J. Huber wird in Pará die Varietät *holosericea* Schauer als Tarúma benutzt."

The *Harley 10841,* distributed as typical *V. polygama,* actually represents its var. *bakeri* Mold., while *Lindeman & Haas 45* is var. *glaziovii* Mold. and *Richards, Ratter, Ramos, & Argent R.501* is *V. panshiniana* Mold.

Additional citations: BRAZIL: Guanabara: *Cuatrecasas & Duarte 26639* (N, W--2586727); *W. Hoehne 5905* (N, W--2771594); *Martins 242* [Herb. FEEMA. 1048] (Ld). Minas Gerais: *A. Castellanos 25421* [Herb. FEEMA. 4229] (Ld); *Irwin, Maxwell, & Wasshausen 20563* (Ld, N); *Irwin, Reis dos Santos, Souza, & Fonsêca 22624* (Ac, N). Paraná: *Hatschbach 18930* (Ld), *20228* (N); *Hatschbach & Kasper 41705* (N). Rio de Janeiro: *W. R. Anderson 11638* (N). São Paulo: *F. C. Hoehne 2546* (P); *Mattos & Mattos 8382* (N, W--2745200); *Vecchi s.n.* [Août-Sept.-Oct. 1928] (P).

VITEX POLYGAMA var. *BAKERI* Mold.

Additional bibliography: Mold., Phytologia 17: 25. 1968; Mold., Fifth Summ. 1: 179 & 374 (1971) and 2: 928. 1971; Mold., Phytol. Mem. 2: 172, 367, & 593. 1980.

Harley refers to this plant as a tree, 12 m. tall, the young shoots, petioles, and under side of the leaves with golden hairs, the fruit soft, with a very hard endocarp, white sweet edible flesh, and dull yellowish-purple skin, and found it in fruit in October, distributing his material as typical *V. polygama.*

The *Oldenburger, Norde, & Schulz ON.323* & *ON.360,* distributed as *V. polygama* var. *bakeri,* actually represent *V. panshiniana* Mold.

Additional citations: BRAZIL: Mato Grosso: *Harley 10841* (N).

VITEX POLYGAMA var. *DUSENII* Mold.

Additional bibliography: Angely, Fl. Anal. Paran., ed. 1, 580. 1965; Mold., Phytologia 17: 25--26. 1968; Mold., Fifth Summ. 1: 180 (1971) and 2: 720, 724, & 928. 1971; Kummrow, Bol. Mus. Bot. Munic. 38: 14. 1979; Mold., Phytologia 44: 342. 1979; Mold., Phytol. Mem. 2: 172 & 593. 1980.

Hatschbach describes this plant as a treelet, 8 m. tall, with pale-blue corollas, and found it growing in rainforests, blossoming in November. Kummrow (1979) cites *Hatschbach 35519.*

Additional citations: BRAZIL: Parana: *Hatschbach 35519* (Ld). Rio de Janeiro: *G. Gardner 582* (P).

VITEX POLYGAMA var. *GLAZIOVII* Mold.

Additional bibliography: Mold., Phytologia 17: 26. 1968; Mold.,

Fifth Summ. 1: 180 (1971) and 2: 928. 1971; Mold., Phytol. Mem. 2: 172 & 593. 1980.

Recent collectors refer to this plant as a tree, 4--5 m. tall, the trunk 12--15 cm. in diameter at breast height, the fruit at first yellow-green, then black-violet and edible, and have found it growing in cerrado and cutover slope forests, at 610--975 m. altitude, in anthesis in November, and in fruit in March.

Material has been distributed in some herbaria as typical *V. polygama* Cham.

Additional citations: BRAZIL: Minas Gerais: *Irwin, Fonseca, Souza, Reis dos Santos, & Ramos 27322* (N, Z), *28145* (N). Rio de Janeiro: *Lindeman & Haas 45* (N).

VITEX POLYGAMA var. *HIRSUTA* Schau.

Additional bibliography: C. Muell. in Walp., Ann. Bot. Syst. 5: 712. 1860; Mold., Phytologia 17: 25 & 26. 1968; Angely, Fl. Anal. Fitogeogr. Est. S. Paulo, ed. 1, 4: 828 & xix. 1971; Mold., Fifth Summ. 1: 180 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 172 & 593. 1980.

The Angely (1971) reference cited above is sometimes cited by its erroneous titlepage date of "1970".

VITEX POLYGAMA var. *WARMINGII* Mold.

Additional bibliography: Mold., Phytologia 17: 26. 1968; Mold., Fifth Summ. 1: 180 (1971) and 2: 709 & 929. 1971; Mold., Phytol. Mem. 2: 172 & 593. 1980.

Maguire and his associates refer to this plant as a tree, 6 m. tall, the trunk 15 cm. in diameter at breast height, the calyx red-brown, and the corollas purple. They found it "occasional" in gallery forests, blossoming in October.

Additional citations: BRAZIL: Distrito Federal: *Maguire, Murça Pires, Maguire, & Silva 57114* (N, Z).

VITEX POOARA Corbishley

Additional bibliography: Fedde & Schust., Justs Bot. Jahresber. 48 (1): 498. 1927; Mold., Phytologia 17: 26. 1968; Hyland, U. S. Dept. Sgr. Pl. Invent. 173: 103. 1969; Mold., Fifth Summ. 1: 249, 258, & 375 (1971) and 2: 726 & 929. 1971; Palmer & Pitman, Trees South. Afr., ed. 2, 3: 1951--1953 & 1955. 1972; Gibbs, Chemotax. Flow. Pl. 3: 1752. 1974; Mold., Phytol. Mem. 2: 238, 247, 367, & 593. 1980.

Illustrations: Palmer & Pitman, Trees South. Afr., ed. 2, 1952 & 1953. 1972.

Palmer & Pitman (1972) record the vernacular names, "mphuru" and "stinkbessie" for this species and describe it as follows: "This little *Vitex* species is common in the sour bushveld of the Waterberg in the Transvaal and is recorded as far north as Soutpansberg. Many trees grow alongside the Great North Road north of Warmbaths. It is a small, shrubby tree with a light brown, ribbed trunk up to about 15 cm in diameter [with ribbed and cracked bark], spreading branches, and a beautiful, leafy rounded crown of velvety, often rather blue-green foliage, with the young yellow-green twigs con-

spicuous.

"The compound leaves are composed of 5 to 7 very shortly stalked or sessile leaflets arranged digitately.....the whole leaf borne stiffly on a long, hairy, khaki stalk. The leaflets are 2.5--7.5 cm long -- the terminal the largest -- egg-shaped, oblong, oval, or widely lance-shaped, more or less velvety, a dullish blue-green or pale green, the midrib and veins on the undersurface yellow and prominent. The young growth is a fine, furry, golden-brown. The flowers -- mauve, blue or violet -- are borne in early summer in long-stalked clusters in the axils of the leaves.

"The acorn-like fruits are round, up to 1.3 or 1.9 cm long, green spotted with white, turning a deep purple-brown or black, and shiny. The calyx is cup-like and conspicuous. They are borne in profusion -- it is recorded that one tree bore over 2000 -- and in February weigh down the branches. At this time the little trees are luxuriant-looking and are noted by most travellers along the Waterberg roads. The fruits contain Vitamin C -- 80 mg per 100 g -- and are eaten not only by birds but by people -- and this is unusual among the South African species of *Vitex*. They have a strong odour and give those who eat them a persistent, unpleasant smell said to resemble that of bedbugs! They are well liked in spite of this and Pedi women are said to be willing to give a days work to a farmer in exchange for permission to gather them on his property. The juice leaves a black or purple stain. Long after the fruit has vanished, the calyx is sometimes seen decorating a twig, like an empty saucer.

"This species has affinities with *Vitex harveyana* and is held by some botanists to be inseparable. The specific name *pooara* is an African name."

Watt & Breyer-Brandwijk (1962) list the vernacular name, "mburo", for this species, reporting also that the fruit is edible "and enters into the Pedi dietary.....Both vegetative and reproductive organs are said to yield hydrocyanic acid." Gibbs (1974) reports cyanogenesis present.

Corbishley (1900) cites *H. Bolus 12233, Burtt-Davy 1722,* and *Pole-Evans 19671* from Transvaal. Hyland (1969) cites *U. S. Dept. Agr. Pl. Invent. 306235* from "S. Africa", cultivated in Maryland.

Recent collectors describe this species as a small tree, 12 feet tall, and have encountered it in woods, flowering in November. The corollas are said to have been "white & blue" on *Marais 1263.*

Additional citations: SOUTH AFRICA: Transvaal: *Fries, Norlindh, & Weimarck 1984* (Mu); *Marais 1263* (Mu); *Theron 2049* (Mu).

VITEX PSEUDOCHRYSOCARPA Pieper

Additional bibliography: Wangerin, Justs Bot. Jahresber. 56 (1): 669. 1936; Fedde & Schust., Justs Bot. Jahresber. 57 (2): 403. 1938; Mold., Phytologia 17: 27. 1968; Mold., Fifth Summ. 1: 210, 223, & 232 (1971) and 2: 715, 726, & 929. 1971; Mold., Phytol. Mem. 2: 201, 213, 221, & 593. 1980.

VITEX PSEUDOCUSPIDATA Mildbr.

Additional bibliography: Mold., Phytologia 17: 27. 1968; Mold.,

Fifth Summ. 1: 224 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 215 & 593. 1980.

VITEX PSEUDOLEA Rusby

Additional bibliography: R. C. Foster, Contrib. Gray Herb. 184: 171. 1958; Macbr., Field Mus. Publ. Bot. 13 (5): 692 & 696--697. 1960; Mold., Phytologia 17: 27. 1968; Mold., Fifth Summ. 1: 144 & 184 (1971) and 2: 929. 1971; Soukup, Biota 11: 20. 1976; Mold., Phytol. Mem. 2: 136, 176, & 593. 1980.

Steinbach describes this plant as an erect tree, 6 m. tall, the calyx green-ochre, and the corollas vivid violet, pale on the back, and has found it "not very frequent in the area between dry-ground forest and river", at 300 m. altitude, flowering in November. Macbride (1960), although accepting the species, comments, quite reasonably, that it is "probably" conspecific with the more northern *V. cymosa* Bert. and states that the sweet fruit is eagerly eaten by children and the bark is used by their elders in the treatment of rheumatism. He cites only *Ferreyra 4829* from Peru.

Additional citations: BOLIVIA: Cochabamba: *R. F. Steinbach 464* (Lb--64801, N, W--2533384, Ws).

VITEX PUBERULA J. G. Baker

Additional & emended bibliography: J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 317 & 330. 1900; Exell, Journ. Bot. 69, Suppl. 2: 146. 1931; Mold., Phytologia 17: 27. 1968; Mold., Fifth Summ. 1: 245 (1971) and 2: 716 & 929. 1971; Mold., Phytologia 44: 395. 1979; Mold., Phytol. Mem. 2: 235 & 593. 1980.

Baker (1900) cites only the type collection, *Welwitsch 5668*, from Angola, deposited in the British Museum herbarium and there photographed by F. G. Meyer as his type photograph number 2996.

Additional citations: ANGOLA: Loanda: *Welwitsch 5668* [F. G. Mey. photo 2996] (Gz--photo of type, N--photo of type).

VITEX PULCHRA Mold.

Additional bibliography: Mold., Phytologia 17: 27. 1968; Mold., Fifth Summ. 1: 263 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 252 & 593. 1980.

VITEX PYRAMIDATA B. L. Robinson

Additional bibliography: Pittier, Contrib. U. S. Nat. Herb. 20: 483. 1922; Rzedowski & McVaugh, Contrib. Univ. Mich. Herb. 9: 42 & 107. 1966; Mold., Phytologia 17: 27--28. 1968; M. Martínez, Pl. Med. Mex., ed. 5, 403. 1969; Mold., Fifth Summ. 1: 77 (1971) and 2: 709, 725, 726, 730, & 929. 1971; Altschul, Drugs Foods 246. 1973; Hinton & Rzedowski, Anal. Esc. Nac. Cienc. Biol. 21: 112. 1975; Hurd & Linsley, Smithson. Contrib. Zool. 220: 10. 1976; Mold., Phytologia 44: 491 (1979), 45: 491 (1980), and 46: 42. 1980; Mold., Phytol. Mem. 2: 69 & 593. 1980; Mold., Phytologia 48: 458. 1981.

Recent collectors describe this species as a tree, 5--16 m.

tall, with a crown spreading to 10 m., the trunk to 25 cm. in diameter at breast height, and the bark rough, dark-brown, and exfoliating, or as a shrub, 2 m. tall, the fruit abundant, black, edible, and 2-seeded by abortion. They have found it growing on barranca slopes and hillsides, rocky hillsides, pedregal, and in deep steep-sided ravines in open savannas, in low deciduous woods, in rocky soil of open forests, and on igneous slopes with disturbed matorral vegetation, at 100--1500 m. altitude, in anthesis from May to August, and in fruit from July to December. The Andersons report it "common" in Jalisco, Mexico.

The corollas are said to have been "blue" on *Fryxell 3037, Mason & Mason 3346, Oliver & al. 667,* and *Rzedowski 15267,* "dark-blue, slightly purplish" on *Anderson & Anderson 5092,* and "violet-blue" on *Johnston & al. 12253.* Johnston and his associates encountered this tree "in pastizal badly disturbed agriculturally "by swimming-pool and waterfall at edge of a tremendous barranca, in grassy and sandy soil derived from extrusive igneous rocks, with *Bursera* and other species of *Vitex*",and "among rolling hills of volcanic ash, in black calcareous clay where not eroded away, with *Croton* and *Bouteloua* species".

Vernacular names recently reported for the species are "capulin", "hupari", "querenda", and "querengue". Altschul (1973), citing *Standley 2952,* reports the fruits edible, while Martínez (1969) says: "En Jalisco echan las hojas en agua hirviendo para aspirar los vapores a fin de combatir los accesos de asfixia que sobrevienen por efecto de la picadura de los alacranes. En cocimiento de los fructos y de las hojas se emplea como remedio para la diarrea. En Morelos y Tlapa, Gro., se recomienda como pectoral tomando el cocimiento del tallo y de las hojas. En Coahuayana, Mich., consideran a esta planta como útil 'para toda ponzoña y como expectorante'. En Rosa Morada, Nay., usan el cocimiento de 12 hojas para regularizar la menstruación, tomandolo en ayunas." He asserts that the species occurs chiefly in Sonora, Durango, and Jalisco, Mexico.

Standley (1924) separates the Mexican species of the genus (as known to him) as follows:

Leaflets usually 3, corolla densely sericeous-pilose outside..... *V. mollis.*

Leaflets mostly 5, corolla sparsely puberulent or glabrate.

Leaflets densely tomentulose beneath.

Corolla about 12 mm. long, the throat villous.*V. pyramidata.*

Corolla about 8 mm. long, the throat not villous.*V. gaumeri.*

Leaflets glabrous beneath or nearly so.....*V. hemsleyi.*

Material of *V. pyramidata* has been misidentified and distributed in some herbaria as *V. gaumeri* Greenm., *V. hemsleyi* Briq., and *V. mollis* H.B.K. On the other hand, the *Harmon & Fuentes 5987,* distributed as *V. pyramidata,* actually is *V. gaumeri* Greenm., while *Janzen s.n.* [29 May 1964] is something in the *Bignoniaceae.*

Additional citations: MEXICO: Guerrero: *Blanco, Toledo, & Cabrera 530* (Me--276275); *Hinton 5999* (Ba), *6956* (Ba); *Hinton & al. 9990* (Tu--85025), *10005* (Se--120101, Tu--112078); *Rowell 3029* (Mi). Jalisco: *Anderson & Anderson 5092* (Mi, N); *Díaz Luna 237* (Mi);

Gregg 873 (E--2168597); *Johnston, Chiang, & Wendt 12251* (Ld), *12253* (Ld); *Oliver, Verhoek-Williams, & Andreasen 667* (Ba, Ba, Ba, Z); *J. Rzedowski 15267* (Au--233728); *Templeton 7564* (Ne--105412). Mexico: *Hinton 4086* (Tu--127635); *Matuda 38021* (Ft); *R. V. Moran 10159* (Sd--53557). Michoacán: *McVaugh 18020* (Au-236083); *Ventura A. 2469* (Mi, N). Morelos: *Lyonnet 1057* (W--1685842). Nayarit: *Brewer & Mason 1875* (Tu--142810); *Dieterle 3965* (Mi); *Gibson & Gibson 2176* (Ld); *Mason & Mason 3346* (Ld, W--2814827); *J. Rzedowski 17864* (Au--243188). Sinaloa: *Dryxell 3037* (N); *Norris, Peterson, Dowty, Nelson, & Selva 20157* (N).

VITEX QUINATA (Lour.) F. N. Will.

Additional & emended synonymy: *Vitex heterophylla* Kurz apud C. B. Clarke in Hook. f., Fl. Brit. India 4: 585, in syn. 1885. *Stereosperma n. 7* Hook. f. & Thoms. ex C. B. Clarke in Hook. f., Fl. Brit. India 4: 585, in syn. 1885. *Vitex quinata* Williams, Bull. Herb. Boiss., ser. 2, 5: 431. 1905; Lévl., Cat. Pl. Yun-Nan 278. 1917 [not *V. quinata* Schumacher, 1940]. *Vitex trifolia* var. *trifoliolata* Naves apud H. Hallier, Meded. Rijks Herb. Leid. 37: 46, in syn. 1918 [not *V. trifolia* var. *trifoliolata* H. J. Lam, 1961, nor Schau., 1958]. *Vitex leucoxylon* Blume apud H. Hallier, Meded. Rijks Herb. Leid. 37: 46, in syn. 1918 [not *V. leucoxylon* Blanco, 1895, nor L, 1929, nor L. f., 1781, nor Naves, 1918, nor Roth, 1956, nor Roxb., 1814, nor Schau., 1893, nor Span., 1856, nor Wall., 1847, nor Willd., 1832]. *Vitex heterophylla* Zoll. & Mor. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 46, in syn. 1918 [not *V. heterophylla* Blume, 1858, nor Schau., 1919]. *Vitex heterophylla* var. *genuina* H. J. Lam in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 55. 1921. *Vitex heterophylla* var. *undulata* C. B. Clarke ex Fletcher, Kew Bull. Misc. Inf. 1938: 405. 1938. *Vitex quinata* Druce ex El-Gazzar & Wats., New Phytol. 69: 485. 1970. *Vitex urceolata* sensu Mold. ex Hsiao, Fl. Taiwan 4: 434, in syn. 1978 [not *V. urceolata* C. B. Clarke, 1885]. *Vatex guinata* (Lour.) F. N. Will. ex Mold., Phytol. Mem. 2: 446, in syn. 1980. *Vitex heterophylla forma glabra crassifolia macrantha* Griff. ex Mold., Phytol. Mem. 2: 458, in syn. 1980. *Vitex quinata* F. Vill., in herb.

Additional & emended bibliography: Lour., Fl. Cochinch., ed. 1, 387 (1790) and ed. 2, 470. 1793; Raeusch., Nom. Bot., ed. 3, 173. 1797; Roxb., Hort. Beng., imp. 1, 46. 1814; Sweet, Hort. Brit., ed. 2, 416. 1830; Wall., Numer. List 86. 1831; Loud., Hort. Brit., ed. 2, 551. 1832; Roxb., Fl. Ind., ed. 2, imp. 1, 3: 75. 1832; G. Don in Sweet, Hort. Brit., ed. 3, 551. 1839; D. Dietr., Syn. Pl. 3: 612. 1843; Voigt, Hort. Suburb. Calc. 469. 1845; Buek, Gen. Spec. Syn. Candoll. 3: 502. 1858; Miq., Fl. Ind. Bat. Suppl. 1: 95, 242, & 567. 1860; Roxb., Fl. Ind., ed. 2, imp. 2, 483. 1874; Kurz, Forest Fl. Brit. Burma 2: 269--271 & 612. 1877; Gamble, List Trees Darj. Dist. 61. 1878; Gamble, Man. Indian Timb., ed. 1, 296 & 522. 1881; Naves & Fern.-Villar in Blanco, Fl. Filip., ed. 3, 4 Nov. App.: 160. 1880; Vidal, Sin. Fam. Gen. Pl. Leñ. Filip. [Introd. Fl. For. Filip.] 2: 35, pl. 75, fig. B. 1883; Forbes & Hemsl., Journ. Linn. Soc. Lond. Bot. 26: [Ind. Fl. Sin.] 257--258.

1890; Prain, Bengal Pl., imp. 1, 832 & 833. 1903; Brandis, Indian Trees, imp. 1, 504. 1906; Dunn & Tutcher, Kew Bull. Misc. Inf. Addit. Ser. 10: 201 & 204. 1912; Koord, Exkursionsfl. Java 3: 136, 137, & 495. 1912; Dalla Torre, Justs Bot. Jahresber. 40 (1): 783. 1917; H. Hallier, Meded. Rijks Herb. Leid. 37: 45--46 & 48. 1918; Koord., Philip. Journ. Sci. Bot. 13: 58. 1918; H. J. Lam, Bull. Jard. Bot. Buitenz., ser. 3, 3: 55. 1921; Mattfeld in Dalla Torre, Justs Bot. Jahresber. 43: 166. 1923; E. D. Merr., Enum. Philip. Flow. Pl. 3: 396--397. 1923; Janssonius, Mikrogr. Holz. Java 4: 819--821. 1926; E. D. Merr., Philip. Journ. Sci. 29: 415. 1926; Heyne, Nutt. Pl. Ned. Ind., ed. 2, 1: 24 (1927) and 2: 1315 & 1317. 1927; Dop. Bull. Soc. Hist. Nat. Toulouse 57: 201, 203, & 211. 1928; J. M. Cowan, Rec. Bot. Surv. India 12: 33, 35, 48, & 57. 1929; Fedde & Schust., Justs Bot. Jahresber. 53 (1): 1076. 1932; E. D. Merr., Trans. Am. Phil. Soc., ser. 2, 24 (2) [Comm. Lour.]: 17, 334, & 444. 1935; Kanehira, Formos, Trees, ed. 2, 652--653 & 736, fig. 608. 1936; Wangerin, Justs Bot. Jahresber. 56 (1): 669. 1936; Fletcher, Kew Bull. Misc. Inf. 1938: 405, 432, & 434. 1938; Kanjilal & al., Fl. Assam 3: 458, 478--485, & 561. 1939; Fedde & Schust., Justs Bot. Jahresber. 60 (2): 576. 1941; H. N. & A. L. Mold., Pl. Life 2: 70 & 89. 1948; Janssonius, Key Javan. Woods 54. 1952; Sonohara, Tawada, & Amano, Fl. Okin. 132. 1952; Pételot, Pl. Méd. Cambod. Laos Vietn. 2 [Archiv. Recherch. Agron. Past. Viet-Nam 18]: 250--251 (1953) and 4: 13, 40, 171, 205, & 225. 1954; Liu, Illustr. Nat. Introd. Lign. Pl. Taiwan 2: 1230. 1965; Smitinand, Govt. Sarawak Sympos. Ecol. Res. Humid Trop. Veg. 41--43, fig. 1. 1965; Burkill, Dict. Econ. Prod. Malay Penins. 2: 2279. 1966; Tingle, Check List Hong Kong Pl. 38. 1967; Das, Pakist. Journ. Forest. 18: 308. 1968; Mold., Phytologia 15: 244 & 307 (1968) and 17: 15, 22, 23, & 28--32. 1968; Mold., Résumé Suppl. 16: 29 (1968) and 17: 5, 6, & 12. 1968; Uphof, Dict. Econ. Pl., ed. 2, 546. 1968; El-Gazzar & Wats., New Phytol. 69: 483 & 485. 1970; Brandis, Indian Trees, imp. 2, 504. 1971; Mold., Fifth Summ. 1: 269, 279, 284, 285, 291--294, 298, 303, 307, 314, 318, 320, 328, 331, 333, 338, 344, 375, 469, & 471 (1971) and 2: 710, 713, 715, 718, 719, 721--723, 726--728, 731, 770, & 929. 1971; Roxb., Fl. Ind., ed. 2, imp. 3, 483. 1971; Versteegh, Meded. Landbouwhogdch. Wagen. 71-19: 10, 62, & 63. 1971; Chan & Teo, Chem. Pharm. Bull. 29: 1582--1584. 1972; Foreman, Div. Bot. Dept. For. N. Guin. Bot. Bull. 5: 178. 1972; Huang, Pollen Fl. Taiwan 244. 1972; Mold., Phytologia 23: 438 (1972) and 25: 238 & 243. 1973; Farnsworth, Pharmacog. Titles 8 (1): xvii. 1973; Hartley, Dunstone, Fitzgerald, Johns, & Lamberton, Lloydia 36: 294. 1973; Wanner, Soeroh., Santosa, Natalia, Pang., Yingch., & Nguyen., Pecologia 12: 295. 1973; El-Gazzar, Egypt. Journ. Bot. 17: 75 & 78. 1974; Farnsworth, Pharmacog. Titles 9 (1): xxviii. 1974; Mold., Phytologia 28: 443, 445, & 465 (1974) and 31: 390. 1975; Zimmerm. & Ziegler in Zimmerm. & Milburn, Transp. Pl. 1 [Pirson & Zimmerm., Encycl. Pl. Physiol., ser. 2, 1]: 503. 1975; L. H. & E. Z. Bailey, Hortus Third 1162. 1976; E. H. Walker, Fl. Okin. South. Ryuk. 893 & 894. 1976; Fundter & Wisse, Meded. Landbouwhogsch. Wagen. 77 (9): 205 & 206. 1977; Hsiao, Fl. Taiwan 4: 434.

1978; Mold., Phytologia 44: 225 & 404 (1979) and 46: 483. 1980; Mold., Phytol. Mem. 2: 256, 266, 271, 274, 280, 282, 283, 288, 290, 294, 298, 304, 309, 311, 319, 321, 323, 328, 333, 367, 395, 442, 446, 458, & 593. 1980; Roxb., Hort. Beng., imp. 2, 46. 1980; Mold., Phytologia 49: 171, 172, & 373. 1981.

Emended illustrations: Vidal, Sin. Fam. Gen. Pl. Leñ. Filip. [Introd. Fl. For. Filip.] 2: pl. 75, fig. B. 1883; Kanehira, Formos. Trees, ed. 2, 653, fig. 608. 1936; Liu, Illustr. Nat. Introd. Lign. Pl. Taiwan 2: 1230, pl. 1038. 1962; Smitinand, Govt. Sarawak Sympos. Ecol. Res. Humid Trop. Veg. 42, fig. 1. 1965.

Recent collectors describe this plant as a shrub, 2 m. tall, or small, erect, evergreen tree, 3--30 m. tall, often branching from about 5 feet from the base, but the bole sometimes to 20 m. high and the crown another 8 m. high, the trunk irregularly fissured or fairly deeply fluted. "somewhat swirled", to 1 m. in diameter at breast height and 2.2 m. girth, without buttresses or with buttresses to 2 m. high, 1.6 m. long, and 7.5 cm thick, the bark about 7 mm. thick, the outer bark smooth, soft, scaly, easily detached, greenish, green-yellow, or "greenish-brown, mottled whitish-green", to gray. grayish, white, or brown-gray to pale-yellow or pinkish, the inner bark pale-yellow, yellow, yellowish-white, or yellowish-green to orange-ochre, brownish, brown, reddish, or chocolate, paler near the cambium, the sapwood white, yellowish, reddish-yellow to brown, often watery, the exudate near the cambium colorless, the leaves 3- or 5-foliolate, punctate beneath with oil glands which show as pellucid (reddish) dots, the peduncles dark-brown, the calyx cupuliform, dark-brown, externally dotted with golden glands or scales, the "corolla covered with stiff white appressed hairs", and the fruit at first green or dark-green, later blue, greenish-black, or finally black. The corollas are said to have been "pink" on *Taam 1532,* "violet" on *Niyomdham & al. 193,* "purple" on *Wang 32890,* and "cream" on *Kingdon-Ward 22162.*

Collectors have found this plant growing in brownish, brown, or blackish soil, often stony, in primary or secondary forests on hillsides, in logged or otherwise disturbed forests, on flat land as well as on limestone ridge-tops and in elevated grasslands, in mixed woods, in the partial shade of light woods, in thickets and "open areas", along streams, and in "deep inpenetrable ravines", often in fertile soil, at altitudes of 30--1350 m., in anthesis from April to August, and in fruit from April to January.

Huang (1972) describes the pollen of this species as "Grains prolate to subprolate; 28--33 x 18--22 mu", based on *Sasaki 22463* from Taiwan. Raeuschel (1797) gives the type locality of the Loureiro taxon, which is the basionym of this species, as "Canto Sinar." -- apparently meaning Canton, China. Sweet (1830) and Loudon (1832) assert that the species was introduced into cultivation in England in 1820 from the "E. Indies". The *Gillis 11045,* cited below, is from material cultivated in Florida from seed collected in Kwangtung, China. A wood sample accompanies *SAN.26547* from Sabah.

The so-called *Vitex heterophylla* var. *velutina* of Koorders &

Valeton is a synonym of what is now known as *V. velutina* (Koord. & Val.) Koord, while the *Vitex quinata* var. *fructu majoribus* of Ramos is *Teijsmanniodendron coriaceum* (C. B. Clarke) Kosterm. Foreman (1972) reduces *Vitex quinata* to the synonymy of what he calls *Viticipremna novaepommeranae* (Warb.) H. J. Lam.

Common or vernacular names (or variants thereof) not previously recorded for this species by me include: "arekadal", "ashoi", "bagoaron", "bhatkur", "dieng-sart-udkhar", "fooi-shue", "hukham", "jahama-ashoi", "kaaza'b", "kapapar", "kawariba-ninzinboku", "kětiléng", "khong-sman-bol", "khung-suman", "ki banbara", "ki bangbara", "ki-kam-bara", "koetiléng", "kuburasi", "kulimpapa", "laban", "laban kětiléng", "laban sěmoet", "leban koening", "lebang-boenga", "madang giering", "môa-á", "ngŭ gia bì" [applied also to *Acanthopanax* spp., *Rubus palmatus,* & *Travesia palmata*], "o-ninjin-boku" [large *Panax schinseng* tree], "co-ninjin-boku, "o'-ti^{n}", "o'-ti^{n}-á", "patti'ttu", "po keng", "pò'kiu^{n}", "pu-kiang", "rĕgăâ", "sao", "sao^{n}-po'kiu^{n}", "saraúwet", "taie berak", "tirale-chiang", "various-leaved chaste-tree", and "wild vitex".

Taam asserts that the species is abundant in thickets on dry clay slopes in Hong Kong and fairly common in thickets on dry loamy slopes on Lantao island. Das (1968) records it from Trippera, Pakistan. Walker (1976) and Sonohara & his associates (1952) list it as cultivated on Okinawa; Fernandez-Villar (1880) asserts that he observed living specimens on both Luzon and Panay islands in the Philippines; Kanjilal (1939) lists it from Assam; Voigt (1845) avers that it was in cultivation in the Calcutta area in his time. Schauer (1947) cites only unnumbered Meyen, Wallich, and Zollinger collections from Burma, Java, and Luzon, deposited in the Berlin and DeCandolle herbaria, as well as unnumbered Loureiro and Millet specimens from Canton, China. He comments "Ex icone proxima videtur *V. Timorensi*". [=*V. parviflora* A. L. Juss.]

Roxburgh (1832) states that it is a "tall, slow-growing timber tree, a native of the Tippera forests; it has been fourteen years in the Botanic garden at Calcutta, and is thirty feet high without having blossomed."

Smitinand (1965) reports the species from the upper layer of Hill Evergreen and Lower Montane forests in Thailand, at 1300--1800 m. altitude. Hartley and his associates (1973) cite their numbers *10082* and *11350* from New Guinea. The Baileys (1976) describes the species as a "Shrub or large, tall tree; lfts. 3--5, oblong-elliptic to obovate, to 4 in. long, long-acuminate or caudate, entire, nearly glabrous, gland-dotted; cymes in panicles to 8 in. long; fls. fragrant. Se. Asia, Philippine Isl. Fls. of various colors have been reported." Lam (1921) cites *Prazer 7* from Burma and *Gusdorf 91* from Sumatra. Fletcher (1938) keeps *V. quinata, V. heterophylla,* and *V. heterophylla* var. *undulata* apart as 3 distinct taxa, citing from Thailand for the first: *Kerr 8612, 10637, 16211, 19519, 20503,* & *21441, Lakshnakara 996, Marcan 265, Noe 201, Put 118* & *2841, Suksakorn 941,* and *Winit 546* & *566* (giving Annam & China, Canton [type] as extralimital distribution); for the second: *Kerr 3209, Kiah 24403,*

and *Winit 1373* (with the extralimital distribution of Assam [type], Burma, Malaya, Philippines, China, Hainan, & Formosa); and for the third: *Put 3803* (with the extralimital distribution of Burma [type from Rangoon], Sumatra, Java, and Philippines). In Thailand he reports it from deciduous, evergreen, mixed, mixed deciduous, and bamboo forests, as well as open forests on rocky granite hills, at 20--200 m. altitude.

Walker (1976) amazingly asserts that the type of *Cornutia quinata*, on which *Vitex quinata* is based, is from "East Africa" -- actually it is from Canton, China. Hsiao (1978) asserts that the species is very common in thickets and forests at low altitudes (up to 600 m.) on Taiwan, citing *Faurie 1021, Kawakami & Mori 7, Keng 1369, Matuda 359, Oldham 384,* and *Suzuki 20503*. He places *V. quinata* var. *puberula* (H. J. Lam) Mold. in its synonymy. Prain (1903) records it from Tippera (Pakistan), calling it "A large tree" there. Dunn & Tutcher (1912) list it from Hong Kong, New Territory, Lantao, Taimoshan, Canton, and Lofoushan, describing the corollas as "yellowish-white" and the tree as blossoming in July in the Hong Kong area. They separate *V. quinata* from the closely related *V. urceolata* only by saying that the fruits in the former are 1/5 inch long and in the latter 2/5 inch long. It must be noted here that Merrill (1923) asserts that the corollas are "blue" in *V. quinata* and "yellow" in the closely similar *V. turczaninowii* Merr. -- one wonders if Dunn & Tutcher's statement is really true.

The type of Wallich's *Vitex babula* is *Wallich 1745b* from Gualpora, Assam, India.

Hallier (1918) cites for what we now regard as *Vitex quinata* *Hallier 3513b* from Hong Kong, *3513a* from Luzon, *DeVriese & Teijsmann 28* & *50* from Celebes, *Forbes 2612, Korthals s.n.*, and *DeVriese s.n.* from Sumatra, and *Boerlage s.n., Blume 2158, Junghuhn s.n.*, two Reinwardt collections, and *Zollinger 603* from Java. Regarding *V. heterophylla* var. *undulata* he notes that "Die Varietät scheint nicht deutlich von der Hauptform geschieden zu sein und wurde daher von Gamble nicht aufrecht erhalten" -- nor do I uphold it.

Clarke (1885) cites an unnumbered Jenkins collection from Assam and one of Roxburgh from Tipperah, "East Bengal" for what he regarded the typical form of this species. He distinguished his var. *undulata* as having the "leaves smaller all the upper 3-foliolate, leaflets shining undulate....Branchlets sharply quadrangular. Drupes small", giving *V. undulata* Wall., *V. heterophylla* Kurz, and *Stereosperma n. 7* Hook. f. & Thoms. as synonyms, citing *Helfer 6068* from Tenasserim and unnumbered collections of McLelland and Wallich from Burma [Pegu and Rangoon], and giving Java as extralimital distribution. He also maintained that *Wallich 1756* represented this variety.

Janssonius (1926) gives a lengthy and very detailed description of the macroscopic and microscopic anatomy of the wood of *Vitex quinata*. Gamble (1878) reports that the "wood [is] said to be very good". Uphof (1968) asserts that the slightly aromatic bark is much used in Vietnam as a tonic. Burkill (1966) refers to the species as "A tree found in Burma, southern China, and through Malaysia; in the [Malay] Peninsula it is only known to occur in Perak

and Selangor. The wood is durable and used for native houses in Java; but is rarely available of any size owing to deep flutings in the surface."

Crevost & Pételot (1934) state of the species: "Petit arbre assez commun dans les régions élevées du Tonkin, où on le remarque plus abondant sur les hauteurs de la province de Hoa-binh [Indochina]. Son écorce, légèrement aromatique, surtout quand elle est fraîche, est très employée dans la pharmacopée tonkinoise, qui lui attribue des qualités toniques. On en fair usage, le plus souvent, pilée et macérée dans l'alcool: d'autres fois, on en fait une infusion comme le thé. C'est une drogue très appréciée des indigènes; ils la considèrant comme un singulier stimulant de l'appétit." This is repeated in major part by Pételot (1953).

Merrill (1923) asserts that "Loureiro's type was from the vicinity of Canton and is preserved in the herbarium of the Paris Museum; the species is now very common about Canton. While the Philippine form is not exactly identical with it, it can scarcely be separated." He cites from Leyte, Luzon, Mindanao, and Negros the following collections: *Babaran 26143, Curran 5837, Elmer 11602, Foxworthy, DeMesa, & Villamil 13383, Franco 26871, Mallonga 26007, Merrill 2839, Merritt & Darling 14049, Peña 24686, Rafael & Ponce 20746, Ramos 1410,* and *Wenzel 809*. However, the *Foxworthy, DeMesa, & Villamil 13383, Elmer 11602,* and *Rafael & Ponce 20746* are cited by him also under *V. celebica* Koord. and so actually represent what is now known as *V. quinata* var. *puberula* (H. J. Lam) Mold. In his 1926 work he cites only *no. 1592* from Banguey, with the comment that it represents "a form with trifoliolate leaves" inhabiting open forests there. He gives the species' natural distribution as "India to Formosa through Malaysia to Celebes; not recorded from Borneo proper".

It is worth noting that Williams (1905) is one of the authors who has accepted the erroneous date of "1841" for the original publication of Hooker & Arnott's *Vitex loureirii* which was actually published in 1836.

Material of *Vitex quinata* has been misidentified and distributed in some herbaria as *V. glabrata* R. Br., *V. parviflora* A. L. Juss., *V. pentaphylla* Merr., *V. pubescens* Vahl, *V. turczaninowii* Merr., and *Viticipremna philippinensis* (Turcz.) H. J. Lam. On the other hand, the *Greenwood 344a* and *Sutriano 34,* distributed as typical *V. quinata,* actually represent its var. *puberula* (H. J. Lam) Mold., while *Herb. Philip. Forest. Bur. 11245* and *Katik NGF.37970* are *V. glabrata* R. Br., *Abd 15* is *V. negundo* var. *cannabifolia* (Sieb. & Zucc.) Hand.-Mazz., *Null & Scully 130* is *V. parviflora* A. L. Juss., *Clemens & Clemens 3394* is *V. tripinnata* (Lour.) Merr., *Maxwell 76-318* is *V. tripinnata* var. *pubescens* Mold., and *Wenzel 3430* is *V. turczaninowii* Merr.

Additional citations: INDIA: Sikkim: *T. Anderson 938* (Pd); *T. Thomson s.n.* [Sikkim] (Pd). BURMA: Tenasserim: *Helfer 6068* (Pd); *Wallich 1756/1* (Pd). Upper Burma: *Kingdon-Ward 22162* (Go). CHINA: Kwangtung: *Hance 7494* (Pd). CHINESE COASTAL ISLANDS: Hainan: *Liang 64495* (Mu); *Wang 32890* (Mu), *33204* (Mu), *33757* (Mu).

Lantau: *Taam 1846* (Ba). HONG KONG: *S. Y. Hu 7870* (W--2697115), *8857* (W--2731327); *Taam 1532* (Ba, N). HONG KONG OFFSHORE ISLANDS: High: *S. Y. Hu 8445* (W--2697626). THAILAND: *Larsen, Larsen, Nielsen, & Santisuk 31186* (Ac), *31220* (Ac); *Maxwell 73-720* (Ac); *Nitrasirirak 431* (Ac); *Niyomdham, Sangkachand, Suangto, & Vijitranand 193* (Ac). MALAYA: Malacca: *Griffith 6064* (Pd), *s.n.* (Pd). KOREAN COASTAL ISLANDS: Botel Tobago: *Chang 15019* (W--2920633). PHILIPPINE ISLANDS: Luzon: *Ahern's Collector s.n.* [Herb. Philip. For. Bur. 2961] (N); *M. Ramos s.n.* [Herb. Philip. Bur. Sci. 1410] (N), *s.n.* [Herb. Philip. Bur. Sci. 23485] (W--898055); *Ramos & Edaño s.n.* [Herb. Philip. Bur. Sci. 45318] (N). Mindanao: *Babaran s.n.* [Herb. Philip. Forest. Bur. 26143] (W--1293400): *Mallonga s. n.* [Herb. Philip. Forest. Bur. 26007] (W--1293399); *Wenzel 2523* (Mu, N), *2563* (E--984969), *2912* (Mu), *3430* (E--984973). Samar: *Sulit s.n.* [Philip. Nat. Herb. 14407] (W--2376272). GREATER SUNDA ISLANDS: Java: *Koorders 9834b* (Pd), *12846b* (Pd). Sabah: *Ampuria SAN.43503* (Sn--47559); *Balinsa SAN.70457* (Sn--42135); *Binideh BK.798* [SAN.55812] (Sn); *Gibot 46480* (Ld); *Madani 47191* (Ld); *Mungkim 45115* (Kl--18419, Ld); *Native Collector 23494* (Ld); *Pitty & Ogata SAN.63263* (Z); *M. Ramos 1869* (W--1291403); *R. Offic. Kenned. Bay SAN.26547* (Ld); *Rundi 43153* (Ld); *Tuyok & Langgop SAN.68484* (Ld). Sarawak: *Mamlit s.n.* [Herb. Saraw. Forest Dept. S.32636] (Ld); *Sie s.n.* [Herb. Saraw. Forest Dept. S.35397] (Ld). CULTIVATED: Florida: *Gillis 11045* [McClure 99; Pl. Introd. 63797, M-1319] (Ba, Ba. Z). India: *Wallich 1745 A* (Pd). MOUNTED CLIPPINGS: E. H. Walker, Pl. Okin. South. Ryuk. 894. 1976 (W).

VITEX QUINATA var. *PUBERULA* (H. J. Lam) Mold.

Additional bibliography: Heyne, Nutt. Plant. Nederl. Ind., ed. 1, 111--112. 1917; E. D. Merr., Philip. Journ. Sci. Bot. 13: 58. 1918; H. J. Lam, Bull. Jard. Bot. Buitenz., ser. 3, 3: 55 & 56. 1921; Heyne, Nutt. Plant. Nederl. Ind., ed. 2, 1: 24 (1927) and 2: 1315. 1927; Fedde & Schust., Justs Bot. Jahresber. 53 (1): 1076 (1932) and 60 (2): 576. 1941; Liu, Illustr. Nat. Introd. Lign. Pl. Taiwan 2: 1230. 1962; Mold., Phytologia 17: 31--32. 1968; Mold., Résumé Suppl. 17: 6. 1968; Uphof, Dict. Econ. Pl., ed. 2, 545. 1968; Mold., Fifth Summ. 1: 291, 293, 298, 303, 307, 314, 318, 320, 328, 333, 338, 344, & 375 (1971) and 2: 715, 718, 722, 770, & 929. 1971; Heathcote in Heywood, Flow. Pl. World 237. 1978; Mold., Phytol. Mem. 2: 280, 282, 288, 294, 298, 304, 309, 311, 319, 323, 328, 333, 367, & 593. 1980; Mold., Phytologia 46: 483 (1980) and 49: 373. 1981.

Recent collectors describe this plant as a medium-sized tree, 8--30 m. tall, the irregular bole 5--15 m. high, 15--120 cm. in diameter at breast height, more often with a girth of 50--75 cm., fluted, the buttresses low or up to 3 m. high, almost straight, the basal 0.5--1 m. concave, extending to 1 m. along the ground, the crown about 8 m. high, the outer bark smooth or rather smooth, soft, thin, superficially or deeply wavy-fissured, the strips 2--4 cm. wide and 4 mm. thick, 1 mm. easily rubbed off, gray, grayish, or white to light-brown, yellowish-brown, or yellowish, inner bark greenish-white to cream-brown or chocolate, the living

bark 3--10 mm. thick, brown or pale-brown to yellowish, the sapwood soft, white to dirty-white or cream-color, the leaves glossy green above, dull light-green beneath, the inflorescences gray, their branches brownish-green, the flower-buds yellowish, the flowers zygomorphic, the calyx purplish, the stamens bluish, the fruit at first yellowish-green or green, sweet-tasting, and the seeds hard. They have found it growing in light and hardwood forests, on limestone soil and "coral habitats", in sandy soil on low ridges, and in "low yellow loam", at altitudes of 5 to 1000 m., in anthesis from April to August and in October, in fruit from March to May and in September. Conn & Katik refer to it as an erect canopy species in New Guinea; Greenwood reports it abundant on Viti Levu, while Kostermans asserts that it is "scarce" or "rare" in Borneo.

The corollas are said to have been "pale-purple" on *Greenwood 344a,* "white" on *Fox 99,* "yellow-green with purple dots" on *Conn & Katik LAE.66035,* "whitish, the lower lobe bluish" on *Maxwell 74-697,* "dirty-white, the lower lip dark-purple inside" on *Kostermans 6895,* and "central lobe purple" on *Sutriano 34.* Uphof (1968) calls it a tall tree, the wood hard, heavy, of fine texture, elastic, resistant to moisture, used for house-building, bridges, and boats. Heyne (1917) describes the wood in detail and distinguishes several varieties on wood characteristics.

Vernacular names reported for the variety are "banawoi", "basal", "boengis", "bolowaro", "gofassa batoe", "gofassa gaba", "maka poja", "manonang", "masarawèt sĕla", "morofala", "paday", "papakĕlan", "rimoewas", "saoe masarawĕt", "saoe poeti", "saoe rĕndai", and "woelas watoe".

Lam (1921) cites *Koorders s.n.* and *Zollinger & Moritzi 2670* from Java, asserting that the tree grows also in the Molucca Islands. Liu (1962) sinks *Vitex celebica* Koord. in the synonymy of the typical form of *V. quinata.* Maxwell asserts that his *no. 74-697,* cited below, came from the "same tree" as his *no. 73-720,* herein cited as the typical form. Merrill (1918) cites from Mindanao, Philippines: *Elmer 11602, Foxworthy, DeMesa, & Villamil 13383, Hutchinson 6543, Pray 15420,* and *Rafael & Ponce 20746.*

Material of *Vitex quinata* var. *puberula* has been misidentified and distributed in some herbaria as typical *V. quinata* (Lour.) F. N. Williams, as well as *V. glabrata* R. Br., *V. heterophylla* var. *undulata* C. B. Clarke, *V. parviflora* A. L. Juss., *V. pentaphylla* Merr., *V. pubescens* Vahl, and *V. turczaninowii* Merr.

Additional citations: THAILAND: *Larsen & Larsen 33443* (Ac, Ld); *Maxwell 74-697* (Ac). MALAYA: Perak: *Corner 31625* (Bz--24152). PHILIPPINE ISLANDS: Leyte: *F. Franco s.n.* [Herb. Philip. Forest. Bur. 26871] (W--1294728). Luzon: *Fox 99* [Philip. Nat. Herb. 4706] (Mi); *E. D. Merrill 2839* (W--437809); *Whitford 1335* (N). Mindanao: *Elmer 11602* (Bi, W--873093). Palawan: *Cenabre s.n.* [Herb. Philip. Forest. Bur. 29207] (W--1262435). PALAU ISLANDS: Todaiyama: *Kanehira 2022* (W--1656937). GREATER SUNDA ISLANDS: Java: *Backer 10481* (Bz--25057); *Kostermans 30a* (N). Kalimantan: *Kostermans 6895* (N), *10566* (N), *13770* (N). Sabah: *Mungkim 45115* (N); *Sales 3912* (Pd); *Talip SAN.68321* (N). Sarawak: *Brooke 10354* (W--2332023). FIJI ISLANDS:

Viti Levu: *Degener & Degener 32113* (Ac); *Greenwood 344a* (W--2092566); *A. C. Smith 4307* (N), *6295* (N). NEW GUINEA: Territory of New Guinea: *Conn & Katik LAE.66035* (Mu). CULTIVATED: Java: *Sutriano 34* [Herb. Hort. Bogor. XI.I.35] (Ba, N).

VITEX QUINATA var. *SERRATA* Mold., Phytologia 17: 32. 1968.
Bibliography: Mold., Phytologia 17: 30 & 32. 1968.

VITEX QUINATA var. *WITTROCKIANA* Mold.
Additional bibliography: Mold., Phytologia 6: 107--108. 1957; Mold., Fifth Summ. 1: 375 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 367 & 593. 1980.

VITEX RADULA Mildbr.
Additional bibliography: Fedde & Schust., Justs Bot. Jahresber. 57 (2): 402. 1938; Mold., Phytologia 17: 32--33, 35, & 44. 1968; Mold., Biol. Abstr. 50: 418. 1969; Mold., Fifth Summ. 1: 232, 239, 247, 250, & 253 (1971) and 2: 727 & 929. 1971; Mold., Phytol. Mem. 2: 221, 228, 236, 239, 242, & 593. 1980.

VITEX RAPINI Beauvis.
Additional bibliography: Mold., Phytologia 17: 33. 1968: Mold., Fifth Summ. 1: 343 (1971) and 2: 616, 727, & 929. 1971; Mold., Biol. Abstr. 53: 5252 (1972) and 53 (10): N.A.S.I.C. S.266. 1972; Mold., Phytol. Mem. 2: 332 & 594. 1980.
Recent collectors describe this plant as a slender shrub, 4 m. tall, sparsely branched, or a tree, 3--6 m. tall, the bark ochraceous, scaly, the leaves very dark glossy-green above [or "rufoviridia" acc. to Bernardi]. light glossy-green beneath, the cymes divaricate [and "luteae" acc. Bernardi], the fruit red, turning purple. The corollas are said to have been "brown-orange" on *Baumann-Bodenheim 15807* and "red" on *McKee 7796*.
Collectors have encountered this plant on serpentine rock, at 600--1000 m. altitude, flowering and fruiting in November and December, in fruit also in April. Bernardi refers to it as "apparently rare" and found it "per viam paratam ad metallum (nickel) extrahendum et in fruticetis; summo monte dispersim *Araucariae montanae* Brongn. & Gris. extolluntur monstrosae, rami quasi brachia assurgentes supra frutices misellos".
The *Baumann-Bodenheim 8243,* distributed as typical *V. rapini,* is hereinafter cited as f. *dentata* Mold., while his *no. 14898* and *Deplanch 486* are var. *nana* Mold. and *Baumann-Bodenheim 15809* is the type collection of f. *dentata* and *Hürlimann 1645* is the type collection of var. *nana*.
Additional citations: NEW CALEDONIA: *Baumann-Bodenheim 15807* (N); *Bernardi 12544* (W--2749424); *Guillaumin & Baumann-Bodenheim 12613* (N); *McKee 7796* (W--2375624).

VITEX RAPINI f. *DENTATA* Mold., Phytologia 22: 126. 1971.
Bibliography: Mold., Fifth Summ. 1: 343 (1971) and 2: 929. 1971; Mold., Phytologia 22: 126. 1971; Mold., Biol. Abstr. 53: 5252 (1972) and 53 (10): B.A.S.I.C. S.266. 1972; Mold., Phytol. Mem. 2:

332 & 594. 1980.

This probably juvenile form differs from the typical form of the species in having the leaflet-margins very coarsely serrate.

It is based on *Baumann-Bodenheim 15809* from serpentine maquis on the crest of Mt. Bouo (Koghis), at 700--1000 m. altitude, New Caledonia, collected on November 6, 1951, at deposited at the New York Botanical Garden. The collector describes the plant as a shrub, 2 m. tall. It has hitherto been identified as and material distributed in herbaria as typical *V. rapini* Beauvis.

Citations: NEW CALEDONIA: *Baumann-Bodenheim 8243* (N), *15809* (N--type).

VITEX RAPINI var. *NANA* Mold., Phytologia 22: 126--127. 1971.

Bibliography: Mold., Fifth Summ. 1: 343 (1971) and 2: 929. 1971; Mold., Phytologia 22: 126--127. 1971; Mold., Biol. Abstr. 53: 5252 (1972) and 53 (10): B.A.S.I.C. S.266. 1972; Mold., Phytol. Mem. 2: 332 & 594. 1980.

This form differs from the typical form of the species in its prostrate stature and smaller leaflets, the latter only 1.5--6 cm. long and 1.2--3.5 cm. wide.

It is based on *Hürlimann 1645* from crevices in peridotic rocks on the summit of Mt. Moné (Koghis), at 1079 m. altitude, New Caledonia, collected on July 18, 1951, and deposited at the New York Botanical Garden. The collector describes the plant as a shrub, 50 cm. tall, with rose-colored "flowers" [corollas] and green fruit. The Deplanch collection, cited below, was previously regarded by me and cited by me as typical *V. rapini*.

Citations: NEW CALEDONIA: *Baumann-Bodenheim 14898* (N); *Deplanch 486* (Br, C, E--photo, N--photo, Pd, V); *Hürlimann 1645* (N--type).

VITEX RAPINOIDES Guillaum.

Additional bibliography: Fedde & Schust., Justs Bot. Jahresber. 60 (2): 576. 1941; Mold., Phytologia 17: 34. 1968; Mold., Fifth Summ. 1: 341 (1971) and 2: 727 & 929. 1971; Mold., Phytol. Mem. 2: 331 & 594. 1980.

Wilson refers to this plant as a large tree, the trunk 2 feet in diameter, the corollas bell-shaped, pink, and the fruit red, 1/2 inch long and 5/8 inch in diameter. He found it in flower and fruit in September and notes that it was "common" near the seashore at about 50 m. altitude. He reports the vernacular name, "incdic".

Additional citations: NEW HEBRIDES: Aneityum: *J. P. Wilson 992* (N--isotype).

VITEX REGNELLIANA Mold.

Additional bibliography: Mold., Phytologia 17: 34. 1968; Angely, Fl. Anal. Fitogeogr. Est. S. Paulo, ed. 1, 4: 828 & xix. 1971; Mold., Fifth Summ. 1: 180 (1971) and 2: 929. 1971; Mold., Phytologia 25: 230. 1973; Mold., Phytol. Mem. 2: 172 & 594. 1980.

Recent collectors describe this plant as a tree, 5--6 m. tall,

the trunk 20 cm. in diameter at breast height, and the [probably immature] fruit green. They have found it growing on steep cerrado hillsides and on riacho margins in cerrado, at 1000--1750 m. altitude, in anthesis in October and in fruit in January. The corollas are said to have been "lavender, the lower lip dark blue-violet, the throat with violet lines" on *Irwin & al. 9611*. The Angely (1971) publication, cited above, is sometimes cited by the incorrect titlepage date of "1970".

Additional citations: BRAZIL: Distrito Federal: *Irwin, Souza, & Reis dos Santos 9611* (N, Z). Minas Gerais: *Irwin, Harley, & Onishi 29465* (Ld, N, W--2759079).

VITEX REHMANNI Gürke

Additional bibliography: Kirtikar & Basu, Indian Med. Pl., ed. 1, 1936. 1918; Mold., Phytologia 17: 34. 1968; Mold., Fifth Summ. 1: 258 (1971) and 2: 727 & 929. 1971; Palmer & Pitman, Trees South. Afr., ed. 2, 3: 1951, 1956, 1957, & 1959. 1972; [Farnsworth], Pharmacog. Titles 7, Cum. Gen. Ind. [118]. 1975; Gibson, Wild Fls. Natal 92, fig. 8. 1978; Mold., Phytologia 44: 339. 1979; Mold., Phytol. Mem. 2: 247 & 594. 1980.

Additional illustrations: Palmer & Pitman, Trees South. Afr., ed. 2, 3: 1956. 1972; Gibson, Wild Fls. Natal opp. 92 (in color). 1978.

Gibson (1978) describes this species as "A small tree with white or mauve clusters of flowers. It thrives in bushveld conditions in Zululand, the Midlands and Northern Natal, flowering profusely in November and December." Watt & Breyer-Brandwijk (1962) list the vernacular name, "umluthu", and report that the Zulu make an infusion of the leaves of this species and administer it as an enema in the treatment of stomach-ache.

Palmer & Pitman (1972) list the vernacular names, "mokwele", "pypsteel", "umDuli", "umLuthu", and "vaalbos", reporting that the species "is fairly widely distributed from Natal.....Zululand and Swaziland, to the Transvaal, where it is abundant in the Waterberg of the central districts and around Rustenburg in the west. It also occurs in the north in the Soutpansberg and the Blouberg. It is a tree of thornveld and mixed bushveld, often growing on rocky, wooded hillsides or on sandy flats. Although it is most often a shrub or small leafy tree, it is not uncommon as a handsome 9 m specimen with twisting branches and a stem up to 30 cm in diameter with a distinctive light grey bark deeply cracked into segments. When young the stem is grey and fairly smooth. The young twigs are softly hairy and marked with leaf scars. The compound leaves have 3--5 leaflets, borne on short stalks springing from the same point. They are 1.9--7.6 cm long and less than 2.5 cm broad -- the side leaflets usually the smallest -- most often slender and narrowed both ends but sometimes oval to oblong, the tips pointed or blunt, smooth above and below smooth or slightly hairy, with the nerves somewhat velvety, and the margins untoothed. They are rather dull green, paler below than above, with the midrib and lateral veins distinct, and are borne on long robust stalks. When crushed, they have a

pleasant smell. The coppice leaves are noticeably broader than those on adult trees. The small, light mauve flowers are borne in branching heads on long stalks in the axils of the leaves in early summer. The fruits, about 6 mm long and somewhat rounded and flattened, are surrounded by the 5-lobed calyx -- which is larger than in the flower -- and which looks like a group of green or brown petals. They ripen about April. Parts of the tree are widely sold by Zulu herbalists as a medicine to treat hysteric fits."

Recent collectors describe the species as a shrub, 0.5 m. tall, or a small tree, 10--17 feet tall, the trunk conspicuously whitish-grey, and found it growing in sandy soil among granite rocks, at the edges of ravines, and frequently on open rocky hillsides, at 1000--1550 m. altitude, in anthesis in November and in fruit in January, February, and June, reporting the vernacular name, "pipe-stem". Cheadle reports it frequent in Natal, while Schlieben found it only scattered in the Transvaal. The corollas are said to have been "white & rose" on *Wood 6794* and "white with pink cross-hatching" on *Schlieben 7526*.

Material of *V. rehmanni* has been misidentified and distributed in some herbaria as *V. zeyheri* Sond, which it closely resembles. On the other hand, the *Meebold 12841*, distributed (at least in some herbaria) as *Vitex rehmanni*, actually is a species of *Cleome*, while *Bayliss BS.6236* is *Vitex agnus-castus* L.

Additional citations: SOUTH AFRICA: Natal: *Cheadle 615* (Mu); *Wood 6794* (E--118190). Transvaal: *Dahlstrand 811* (Go), *1523* (Go), *1954* (Go); *Repton 807* (Ba); *Schlieben 7526* (Mu, W--2272369); *Schlieben & Strey 8289* (Mu); *L. E. Taylor 482* (N); *Theron 2003* (Mu, Mu); *Werdermann & Oberdieck 2012a* (W--2582680).

VITEX REHMANNI f. *SUBTOMENTOSA* Mold.

Additional bibliography: Mold., Phytologia 17: 34. 1968; Mold., Fifth Summ. 1: 258 (1971) and 2: 727 & 929. 1971; Mold., Phytol. Mem. 2: 247 & 594. 1980.

VITEX RESINIFERA Mold.

Additional bibliography: Mold., Phytologia 17: 34. 1968; Mold., Fifth Summ. 1: 263 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 252 & 594. 1980.

VITEX RIVULARIS Gürke

Additional & emended bibliography: Good & Exell, Journ. Bot. 68: Suppl. 2: 144 (1930) and 69: Suppl. [1]: 145. 1931; Hutchins. & Dalz., Fl. W. Trop. Afr., ed. 1, 2: 268 & 275--277, fig. 273. 1931; Huber in Hutchins. & Dalz., Fl. W. Trop. Afr., ed. 2, 2: 445, 446, & 448. 1963; Bouquet, Invent. Pl. Méd. Tox. Cong. Brazz. 33. 1967; Mold., Phytologia 17: 34--35. 1968; Mold., Résumé Suppl. 17: 13. 1968; Mold., Fifth Summ. 1: 220, 221, 223, 228, 232, & 245 (1971) and 2: 715 & 929. 1971; Mold., Phytologia 45: 487. 1980; Mold., Phytol. Mem. 2: 210, 211, 213, 215, 217, 222, 235, & 594. 1980.

It has been reported that the fruit of this species is edible

for man and that it is also eaten by native game. Irvine (1961) describes the wood as hard and white, citing *Irvine 951* and *Vigne 865, 895, & 1094* from Ghana and gives the overall distribution as Ivory Coast to Cameroons. Huber (1963) lists a "*Vitex sp. B*" as "A tree close to *V. rivularis* from which it differs by having the leaves more scabridulous on both sides, obtuse or shortly deltoid at the apex, and the central leaflet with 9--10 pairs of lateral nerves", citing *Olorunfemi FHI.30712* from Cameroons.

Irvine (1930) avers that *Vitex rivularis* inhabits the deciduous forest in Ghana and that its wood is "soft", although he quotes Bunting as saying that it is "A large tree with papery bark and hard wood"; he cites only *Irvine 951*. Gossweiler encountered it at 50 m. altitude.

Material of *V. rivularis* has been misidentified and distributed in some herbaria as *V. bipindensis* Gürke.

Additional citations: CAMEROONS: *Zenker 1333* (Mu--isotype), *2691a* (Mu--4030), *2909* (Mu--4028), *3764* (Mu), *4205* (Mu), *4219* (Mu), *4503* (Mu). ANGOLA: Kongo: *Gossweiler 8721* (W--1239660).

VITEX RUBRA Mold.

Additional bibliography: Mold., Phytologia 17: 35. 1968; Mold., Fifth Summ. 1: 263 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 252 & 594. 1980.

VITEX RUBRO-AURANTIACA DeWild.

Additional bibliography: Mold., Phytologia 17: 35--36. 1968; Mold., Fifth Summ. 1: 232 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 222 & 594. 1980.

Louis encountered this plant at 470 m. altitude, in fruit in December.

Additional citations: ZAIRE: *Louis 518* (W--2090911), *3082* (N), *6174* (W--2090991, W--2090992).

VITEX RUFESCENS A. L. Juss.

Additional bibliography: D. Dietr., Syn. Pl. 3: 611. 1843; Buek, Gen. Spec. Syn. Candol. 3: 502. 1858; Mold., Phytologia 17: 36. 1968; Mold., Fifth Summ. 1: 180 & 375 (1971) and 2: 725, 729, & 929. 1971; Mold., Phytologia 31: 387 (1975) and 46: 41. 1980; Mold., Phytol. Mem. 2: 172, 367, & 594. 1980; Mold., Phytologia 48: 291. 1981.

Recent collectors describe this plant as a tree, 4 m. tall, often insect-galled, the [immature] fruit green, and have found it growing in bracken campo above streams in areas of hillsides with secondgrowth forests and bracken-covered campo sloping down to rivers with blocky sandstone and sandy soil, at 950 m. altitude, fruiting in February. Teixeira reports the vernacular name, "azeitona do mato" and comments: "flôres com cálice verde sujo, corola e estamas arroxeados, fôlhas e petalas possuem pequeños pêlos".

Additional citations: BRAZIL: Minas Gerais: *Anderson, Stieber, & Kirkbride 35678* (Ld, N). Pernambuco: *Teixeira 2563* [Herb. Serg. Tavares 1517] (W--2541825).

VITEX RUFESCENS var. *ABLUDENS* (Mold.) Mold.

Additional bibliography: Mold., Phytologia 17: 36. 1968; Mold., Fifth Summ. 1: 180 (1971) and 2: 725 & 929. 1971; Mold., Phytol. Mem. 2: 172 & 594. 1980.

Silva refers to this plant as a tree, 8 m. tall, the trunk 20 cm. in diameter at breast height, the calyx green, and the corolla "creme com ponta roxa", and encountered it in cerrado, flowering in August. A wood sample accompanies his collection.

Additional citations: BRAZIL: Pará: *Silva 4807* (N, N).

VITEX RUFESCENS var. *PARAËNSIS* Mold., Phytologia 48: 291. 1981.

Bibliography: Mold., Phytologia 48: 291. 1981.

This variety differs from the typical form of the species in its 3 leaflets being much larger, to 18 cm. long and 11 cm. wide, completely sessile, more or less asymmetric, irregularly obovate or broadly elliptic, both surfaces very densely hirsute, the petioles very stout, about 9 cm. long, and very densely hirsute.

Citations: BRAZIL: Pará: *Silva & Rosario 4983* (N--type).

VITEX SAMPSONI Hance

Additional bibliography: Benth. in Benth. & Hook. f., Gen. Pl. 2 (2): 1054. 1876; Forbes & Hemsl., Journ. Linn. Soc. Lond. Bot. 26: [Ind. Fl. Sin.] 258. 1890; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 172. 1895; Mold., Phytologia 17: 19 & 36. 1968; Mold., Fifth Summ. 1: 291 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 280 & 594. 1980.

Dunn & Tutcher (1912) state that this species inhabits hedges and bushy places, has blue "flowers" [corollas], and blossoms from May to September.

Additional citations: CHINA: Kwangtung: *T. Sampson s.n.* [Herb. Hance 13841] (Pd--isotype).

VITEX SCABRA Wall.

Additional bibliography: Schau. in A. DC., Prodr. 11: 695--696. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 502. 1858; C. B. Clarke in Hook. f., Fl. Brit. India 4: 588. 1885; Mold., Phytologia 17: 36--37. 1968; Mold., Fifth Summ. 1: 284 (1971) and 2: 929. 1971; Mold., Phytologia 23: 423. 1972; Mold., Phytol. Mem. 2: 274 & 594. 1980.

Clarke (1885) comments that the type of this doubtfully valid species, *Wallich 1758,* is from Ava, Upper Burma, and is represented in the Wallich Herbarium at Kew "by a branchlet and leaves only". In his numerical list, however, Wallich (1829) gives the type locality as Sagaen.

VITEX SCANDENS Mold.

Additional bibliography: Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 133. 1895; Mold., Phytologia 17: 37. 1968; Mold., Fifth Summ. 1: 338 (1971) and 2: 726 & 929. 1971; Mold., Phytol. Mem. 2: 328 & 594. 1980.

Clemens refers to this plant as a "common scandent bignon. shrub, flowers dull brick-purple with yellowish margin; mossy bush

on tall trees; flowers often seen on trails" and found it at 4000 feet altitude, in anthesis in August.

Additional citations: NEW GUINEA: Territory of New Guinea: *M. S. Clemens 41775a* (Mi).

VITEX SCHAUERIANA Mold.

Additional synonymy: *Vitex montevidensis* β *parviflora* Schau. in A. DC., Prodr. 11: 689. 1847. *Vitex montevidensis* β *parviflora* Cham. ex Buek, Gen. Spec. Syn. Candoll. 3: 502. 1858.

Additional bibliography: Buek, Gen. Spec. Syn. Candoll. 3: 502. 1858; Mold., Phytologia 17: 37. 1968; Angely, Fl. Anal. Fitogeogr. Est. S. Paulo, ed. 1, 4: 828 & xix. 1971; Mold., Fifth Summ. 1: 180 (1971) and 2: 722 & 929. 1971; Mold., Phytologia 36: 48 (1977) and 44: 398. 1979; Mold., Phytol. Mem. 2: 172, 459, & 594. 1980.

The Angely (1971) reference cited above is sometimes cited by its erroneous titlepage date of "1970".

Material of *Vitex schaueriana* has been misidentified and distributed in some herbaria [probably due to an error in label-copying] as *Avicennia schaueriana* Stapf & Leechman. On the other hand, the *Glaziou 14160,* previously cited by me (1957) as *V. schaueriana,* actually represents *V. capitata* Vahl.

Additional citations: BRAZIL: State undetermined: *Sellow s.n.* [Brasilia] (N).

VITEX SCHLIEBENI Mold.

Additional bibliography: Mold., Phytologia 17: 37. 1968; Mold., Fifth Summ. 1: 239 (1971) and 2: 727 & 929. 1971; Mold., Phytologia 44: 393 (1979) and 45: 488. 1980; Mold., Phytol. Mem. 2: 228 & 594. 1980.

Recent collectors describe this plant as a small tree, 2--5.1 m. tall, with many branches and fragrant flowers, and have found it growing at the edges of forests, in riverine forests and forest-margins, and on mountain slopes near streams, at 500 m. altitude, in flower and fruit in March and in anthesis also in December. The corollas are said to have been "white" on *Schlieben 6008.*

Material of *V. schliebeni* has been misidentified and distributed in some herbaria as *V. buchananii* J. G. Baker.

Additional citations: TANZANIA: Tanganyika: *Ludanga DSM.225* (Tz); *Mhoro 611* (Tz), *806* (Tz); *Schlieben 6008* (B--isotype, Ca--1311435--isotype, E--1707177--isotype); *Wingfield, Kabuye, & Vollesen 3468* (Z).

VITEX SCHOMBURGKIANA Schau., Linnaea 20: 483--484. Aug. 1847.

Synonymy: *Vitex schauburgkiana* Schau. ex Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 172, sphalm. 1895.

Additional & emended bibliography: Schau., Linnaea 20: 483--484. Aug. 1847; Schau. in A. DC., Prodr. 11: 690. Nov. 1847; Buek, Gen. Spec. Syn. Candoll. 3: 501 & 502. 1858; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 172. 1895; Pittier, Contrib. U. S. Nat. Herb. 20: 484. 1922; Mold., Phytologia 17: 37. 1968; Mold., Fifth Summ. 1: 131 & 180 (1971) and 2: 576, 715, & 929. 1971; Mold., Phytologia 25: 230 (1973) and 44: 398. 1979;

Mold., Phytol. Mem. 2: 123, 172, & 594. 1980.

The original publication for this species is usually given as Schau. in A. DC., Prodr. 11: 483. 1847, but it has been clearly established that this work was not issued until November 26, 1847, while the Linnaea work (cited above) in which Schauer also described the species was issued in August of 1847, and therefore has priority over the later work.

Recent collectors describe this plant as a shrub, treelet, or tree, to 6 m. tall, the trunk to 1 m. in circumference, the calyx green, and the fruit vermillion, and have found it growing along riversides and on savannas, at 350 feet altitude, in flower from February to April, and in fruit in February, April, and August. They report the vernacular name, "taruma" -- a name applied to many species of this genus in South America. The corollas are said to have been "blue" on *Prance & al. 4623* and "red" on *Rosa & Cordeiro 1511*. In Guyana the species is said to grow "in tree clumps in parkland, light sand on clay soil, the grassland with scattered trees, the dominants being *Curatella, Byrsonima, Trachypogon,* and *Fimbristylis*".

Material of this species has been misidentified and distributed in some herbaria as *V. capitata* Vahl, which it closely resembles.

Additional citations: GUYANA: *D. H. Davis 719* (N); *Goodland & Maycock 357* (W--2546179). BRAZIL: Amazônas: *Prance, Forero, Pena, & Ramos 4623* (N). Roraima: *Murça Pires & Leite s.n.* [Herb. IPEAN.14707 (181)] (Z); *Prance, Stewart, Ramos, Farias, & Monteiro 9579* (Mu, N); *Rosa & Cordeiro 1443* (N), *1511* (N), *1553* (N), *1611* (N).

VITEX SCHOMBURGKIANA var. *GRANDIFLORA* Mold.

Additional bibliography: Mold., Phytologia 17: 37. 1968; Mold., Fifth Summ. 1: 180 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 172 & 594. 1980.

VITEX SCHUNKEI Mold., Phytologia 23: 211--212. 1972.

Bibliography: Anon., Biol. Abstr. 54 (4): B.A.S.I.C. S.279. 1972; Mold., Biol. Abstr. 54: 1725. 1972; Mold., Phytologia 23: 211--212 & 418. 1972; Hocking, Excerpt. Bot. A.23: 290. 1974; Mold., Phytologia 34: 257 & 258. 1976; Soukup, Biota 11: 20. 1976; López-Palacios, Revist. Fac. Farm. Univ. Andes 20: 34. 1979; Mold., Phytol. Mem. 2: 130, 136, & 594. 1980.

Recent collectors describe this plant as a tree, 7--10 m. tall, the trunk to 20 cm. in diameter at breast height, and have encountered it in low forests, at 250--500 m. altitude, flowering in November. They report the vernacular names, "chuta" and "pechiche". The corollas are said to have been "light-violet (2.5 P 5/8)" on *Schunke Vigo 6623*.

Citations: ECUADOR: Morona Santiago: *Little, Ortega, & Vivar 692* (Z). PERU: Loreto: *Schunke Vigo 908* (N--type, W--2865782--isotype), *6623* (W--2704225, W--2704226).

VITEX SEBESIAE H. J. Lam

Additional bibliography: Mold., Phytologia 17: 38. 1968; Mold.,

Fifth Summ. 1: 331 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 321 & 594. 1980.

VITEX SECUNDIFLORA H. Hallier

Additional bibliography: E. D. Merr., Bibl. Enum. Born. Pl. 514. 1921; Hocking, Excerpt. Bot. A.5: 52. 1962; Mold., Phytologia 17: 38. 1968; Mold., Fifth Summ. 1: 329 (1971) and 2: 929. 1971; Mold., Phytologia 43: 252. 1979; Mold., Phytol. Mem. 2: 319 & 594. 1980.

The *Kostermans 21032,* distributed as typical *V. secundiflora* in some herbaria, actually represents its var. *longipes* Mold., while *J. A. R. Anderson S.2644* is not verbenaceous (at least as to the Kuala Lumpur herbarium specimen seen by me, which may actually represent a case of mixed labels during mounting).

VITEX SECUNDIFLORA var. *LONGIPES* Mold., Phytologia 43: 252. 1979.

Bibliography: Mold., Phytologia 43: 252. 1979; Mold., Phytol. Mem. 2: 319 & 594. 1980.

This variety differs from the typical form of the species in the petiolules on the larger leaflets being 10--15 mm. long and all the leaflets being plainly petiolulate.

Collectors describe the plant as a large tree, 80--150 feet tall, with a heavy crown to 35 feet high and a clear irregular bole 50--60 feet high, to 80 cm. in diameter and 75--130 inches in girth, the buttresses short or to 12 feet long, straight, to 10 m. high and gradually merging into the bole, 4 inches thick, the slash yellow, the outer bark fissured or non-fissured, hard, 1/10 inch thick, flakey, peeling off irregularly, reddish-brown or pale reddish-brown to light-gray or gray, the inner bark yellow or yellowish, laminated, 4/10 inch thick, fibrous, flaky, the cambium yellow, the sapwood yellow or pale pinkish-yellow, the heartwood brown, the leaves palmate, the leaflets dark-green above and silvery-green beneath, and the [immature] fruit green or yellowish-green. They have found it growing in primary forests in undulating areas or on hillsides and in dipterocarp forests, often in heavy yellow-red clay, at 200--400 feet altitude, in flower in May, and in fruit from October to December. They report the vernacular name, "laban" -- a name applied to various species of this genus in Pacifica.

The corollas are said to have been "whitish" on *SAN.63671* and "yellow & brown" on *SAN.26696.* Wood samples accompany *SAN.26696* & *26903* and "wood chips" accompany *SAN.47132* -- the last-mentioned annotated by someone (the collector?) as "a mystery to me!"

Material of this variety has been identified and distributed in some herbaria as typical *V. secundiflora* H. Hallier or as *V. pubescens* Vahl.

Citations: GREATER SUNDA ISLANDS: Kalimantan: *Kostermans 21032* (N). Sabah: *P. F. Burgess SAN.47132* (Sn--40949); *Chai SAN.26696* (Sn--40947--type), *SAN.26903* (Sn--20696, Z); *DeWol, Leopold, & Gary SAN.74963* (Sn--40952); *Fox SAN.57656* (Sn--40950), *SAN.63671* (Sn); *Iga SAN.61193* (Sn--40951).

VITEX SEINERI Gürke

Additional bibliography: Fedde & Schust., Justs Bot. Jahresber. 57 (2): 402. 1938; Mold., Phytologia 17: 38. 1968; Mold., Fifth Summ. 1: 247 (1971) and 2: 929. 1971; Mold., Phytol. Mem. 2: 236 & 594. 1980.

VITEX SELLOWIANA Cham.

Additional bibliography: D. Dietr., Syn. Pl. 3: 612. 1843; Schau., Linnaea 20: 484. 1847; Schau. in A. DC., Prodr. 11: 689--690. 1847; Buek, Gen. Spec. Syn. Candol. 3: 502. 1858; H. N. & A. L. Mold., Pl. Life 2: 70 & 82. 1948; Barroso, Rodriguésia 32: 72. 1957; Mold., Phytologia 17: 38. 1968; Angely, Fl. Anal. Fitogeog. Est. S. Paulo, ed. 1, 828, 829, & xxix, map 829. 1971; Mold., Fifth Summ. 1: 180 & 375 (1971) and 2: 727 & 929. 1971; Mold., Phytol. Mem. 2: 172, 367, & 594. 1980.

Barroso (1957) cites *Campos Porto 711* and reports the vernacular names, "taruma de folha miuda" and "tarumazinho". The Angely (1971) work cited in the bibliography (above) is sometimes cited by its erroneous titlepage date of "1970".

Recent collectors refer to this species as a shrub, 1--2 m. tall, treelet, or round-headed tree, 3--4.5 m. tall, the stems 5--8 cm. in diameter at breast height, and the fruit at first green or dark-green, 1.1--1.7 cm. long, 0.9--1.6 cm. wide, reddish on the side exposed to the sun, "brilliantly glaucescent", maturing brown-violet. They have encountered it on steep rocky slopes, in wooded brook valleys, on gray sandy soil, in cerrado, and in the transition zone between cerrado and mata ciliar, at 1500--1800 m. altitude, fruiting in January and February. Irwin and his associates report finding it "on middle slopes with low dense woodland on iron-rich soil interspersed with many outcrops" and "in partial shade of secondary forests on steep slopes with shallow lateritic clay soil".

Additional citations: BRAZIL: Minas Gerais: *Irwin, Harley, & Onishi 29195* (Ac, N), *30296* (N), *30479* (N, W--2759073, Ws); *Irwin, Maxwell, & Wasshausen 19517* (N, N, Z). São Paulo: *Mimura 231* (Mi, W--2483367).

VITEX SERETI DeWild.

Additional bibliography: Mold., Phytologia 17: 38. 1968; Mold., Fifth Summ. 1: 232 (1971) and 2: 929. 1971; [Farnsworth], Pharmacog. Titles 7, Cum. Ind. [118]. 1975; Mold., Phytol. Mem. 2: 222 & 594. 1980.

VITEX SIAMICA F. N. Will.

Additional & emended bibliography: Dop, Bull. Soc. Hist. Nat. Toulouse 57: 202 & 203. 1928; Fletcher, Kew Bull. Misc. Inf. 1938: 405, 407, 432, & 435. 1938; Lam & Meeuse, Blumea 3: 253. 1939; Anon., Kew Bull. Gen. Ind. 1929-1956: 293. 1959; Burkill, Dict. Econ. Prod. Malay Penins. 2: 2278. 1966; Mold., Phytologia 17: 38. 1968; Mold., Fifth Summ. 1: 298 & 307 (1971) and 2: 929. 1971; Van Steenis-Kruseman, Fl. Males., ser. 1, 8 (1): 92. 1974; Mold., Phytologia 34: 266 (1976) and 36: 38. 1977; Mold., Phytol. Mem. 2: 288, 298, & 594. 1980. [to be continued]

ADDITIONAL MATERIALS TOWARD A MONOGRAPH OF THE GENUS *CALLICARPA*. XXVIII

Harold N. Moldenke

Herbarium acronyms used in this paper are the same as used in the original monograph (1936) and in all the subsequent supplements and as most recently listed in PHYTOLOGIA MEMOIRS 2: 463--469 (1980).

CALLICARPA L.

Additional & emended synonymy: *Tomex* L., Nov. Pl. Gen. Diss. Dassow 5. 1747; Sp. Pl., ed. 1, imp. 1, 1: 118. 1753; Gen. Pl., ed. 5, imp. 1, 54. 1754 [not *Tomex* Forsk., 1775, nor Thunb., 1783]. *Porphyria* Lour. ex Meisn., Pl. Vasc. Gen. 2: 200, in syn. 1840. *Spondylococcum* Mitchell ex Meisn., Pl. Vasc. Gen. 2: 200, in syn. 1840. *Callicarpus* L. apud Hassk., Cat. Pl. Hort. Bot. Bogor. Cult. Alt. 136. 1844. *Callicaepa* Rehd. ex Mold., Phytol. Mem. 2: 377, sphalm. 1981. *Collicarpa* L., in herb.

Additional & emended bibliography: L., Amoen. Acad., ed. 3. 1751; L., Phil. Bot., ed. 1, 29. 1751; L., Gen. Pl., ed. 5, imp. 1, 50, 54, [519], & [520]. 1754; B. Juss., Hort. Trian. 1759; L., Gen. Pl., ed. 5, imp. 2, 50, 54, [519], & [520]. 1760; Gled., Syst. 168. 1764; L., Gen. Pl., ed. 6, Ord. Nat. 1764; Gis., Carl. Linn. Prael. Ord. Nat. 499. 1792; Pers., Syst. 159. 1797; Vent., Tabl. 2: 318. 1799; Duchesne, Dict. 5 (6): 246. 1805; St.-Hil., Expos. 1: 247. 1805; Hedw., Gen. 55 & 367. 1806; Roxb., Hort. Beng., imp. 1, [10], [36], & [83]. 1814; Spreng., Anleit. 2 (1): 426. 1817; Nutt., Gen. 1: 100. 1818; Nees, Flora 8: 107--109. 1825; Link, Handb. 1: 447. 1829; Bartl., Ord. 180. 1830; Loud., Hort. Brit., ed. 1, 529. 1830; Schlecht. & Cham., Linnaea 5: 97 (1830) and 6: 372. 1831; Loud., Hort. Brit., ed. 2, 529. 1832; Endl., Gen. Pl. 1: 637. 1838; G. Don in Loud., Hort. Brit., ed. 3, 529. 1839; G. Don in Sweet, Hort. Brit., ed. 3, 550. 1839; Meisn., Gen. 292 (200). 1840; Endl., Enchirid. Bot. 312. 1841; Hook. & Arn., Bot. Beech. Voy. pl. 46. 1841; Reichenb., Nom. 108. 1841;Hassk., Flora 25: Beibl. 26. 1842; Brongn., Enum. Gen. Pl., ed. 1, 64. 1843; Lindl., Veg. Kingd., ed. 1, 663 & 664. 1846; Walp., Repert. Bot. Syst. 6: 690 & 692. 1847; Walp., Ann. Bot. Syst. 1: 543--544. 1849; A. L. Juss. in Orbigny, Dict. Univ. Hist. Nat. 13: 185. 1849; Lemr. in Orbigny, Dict. Univ. Hist. Nat. 3: 50. 1849; Wight, Icon. Pl. Ind. Orient. 4 (3): 15--16, pl. 1480. 1849; Brongn., Enum. Gen. Pl., ed.2, 120. 1850; W. Griff., Icon. Pl. Asiat. 4: pl. 147 & 148, fig. 2. 1854; W. Griff., Notul. Pl. Asiat. 4: 173. 1854; Miq., Ind. Bat. 2: 884. 1857; Turcz., Bull. Soc. Imp. Nat. Mosc. 36 (3): 217--218. 1863; Beddome, Forest. Man. Bot. S. India clxxiii. 1870; Ulrich, Internat. Wörterb., ed. 1, 40. 1871; Pfeiffer, Nom. Bot. 1 (1): 64, 502, 535, 536, & 1853 (1873), 1 (2): 818, 1232, 1244, 1425, 1442, 1742, & 1788 (1874), 2 (1): 6 (1874), and 2 (2): 818, 1244,

1569, 1570, & 1593. 1874; Firminger, Man. Gard. India, ed. 3, 531 & 608. 1874; F. Muell., Descr. Notes Pap. Pl., imp. 1, 1: 91 & 110. 1875; Ulrich, Internat. Wörterb., ed. 2, 40. 1875; Kurz, Forest Fl. Brit. Burma 2: 252, 273--275, & 589. 1877; A. Gray, Synop. Fl. N. Am., ed. 1, 2: 333. 1878; Fern.-Villar in Blanco, Fl. Filip., ed. 3, 4: Nov. App. 158. 1880; Vidal, Sin. Fam. Gen. Pl. Leñ. Filip. [Introd. Fl. For. Filip.] 1: 201--203 & 338 (1883) and 2: 35, pl. 74, fig. C. 1883; Vidal y Soler, Phan. Cuming. Philip. 7, 34, 53, 68, & 134. 1885; A. Gray, Synop. Fl. N. Am., ed. 2, 2: 333. 1886; K. Schum., Engl. Bot. Jahrb. 9: 220. 1887; Durand, Ind. Gen. Phan. 321. 1888; Stahl, Estud. Fl. Puerto Rico, ed. 1, 3: 287, 299--300, & 340. 1888; F. Muell., Sec. Syst. Census Austr. Pl. 1: 173. 1889; F. M. Bailey, Cat. Indig. Nat. Pl. Queensl. 35. 1890; Warb., Engl. Bot. Jahrb. 13: [Pl. Pap.] 426. 1890; Baill., Hist. Pl. 11: 88, 95, 112, 118, & 119. 1891;Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 134--140, 142--144, & 164--166, fig. 62 B. 1895; Bull. Coll. Agric. Tokyo 2: pl. 14, fig. 8--10. 1895; Burkill, Proc. Cambr. Phil. Soc. 9: 96. 1896; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): [381]. 1897; Engl., Syllab. Pflanzenfam., ed. 2, 178 & 199. 1898; K. Schum. & Warb., Notizbl. Bot. Gart. Berl. 2: [Fl. Neu-Pomm.] 144. 1898; Lindl., Treas. Bot., ed. 5, 1: 195. 1899; Quaintance, Canad. Ent. 31: 4. 1899; Koord. & Valet., Meded. Lands Plant. Bat. 42 [Bijd. Booms. Java 7]: 164 & 175--177. 1900; Durand. & Jacks., Ind. Kew. Suppl. 1, imp. 1, 182. 1901; Engl., Syllab. Pflanzenfam., ed. 3, 188 & 217. 1903; J. C. Willis, Dict. Flow. Pl., ed. 2, 279 & 604. 1903; Engl., Syllab. Pflanzenfam., ed. 4, 189 & 221. 1904; Post & Kuntze, Lexicon 90 & 688. 1904; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 1, 471, 473, & 480. 1906; Engl., Syllab. Pflanzenfam., ed. 5, 192 & 226. 1907; J. C. Willis, Dict. Flow. Pl., ed. 3, 283 & 621. 1908; Engl., Syllab. Pflanzenfam., ed. 6, 198 & 232. 1909; Hayata, Journ. Coll. Sci. Imp. Univ. Tokyo 30 (1): 218--223. 1911; Lévl., Feddes Repert. Sp. Nov. 9: 455--456. 1911; C. K. Schneid., Illustr. Handb. Laubholzk. 2: 590--594, fig 384 c--g & 385 b--m. 1911; Urb., Symb. Antill. 4: 536. 1911; Gilg in Engl., Syllab. Pflanzenfam., ed, 7, 314 & 363. 1912; Koord., Excursionsfl. 3: 132, 134, & 381--382. 1912; W. & J. Leeuwen-Reijnvaan, Marcellia 11: 49--55. 1912; E. D. Merr., Philip. Journ. Sci. Bot. 7: 165 & 338--341. 1912; Petch, Ann. Roy. Bot. Gard. Perad. 5: 251. 1912; Urb., Symb. Antill. 7: 355--357. 1912; Fedde & Schust., Justs Bot. Jahresber. 39 (2): 319. 1913; Sydow, Justs Bot. Jahresber. 40 (1): 402 & 438. 1913; Wangerin, Justs Bot. Jahresber. 39 (1): 493 (1913) and 40 (1): 511 & 519. 1913; Fedde & Schust., Justs Bot Jahresber. 40 (2): 334. 1915; Thonner, Flow. Pl. Afr. 469. 1915; Fedde, Justs Bot. Jahresber. 39 (2): 1331. 1916; Nienburg, Justs Bot. Jahresber. 39 (2): 1051. 1916; Dalla Torre, Justs Bot. Jahresber. 40 (1): 777. 1917; Fedde & Schust., Justs Bot. Jahresber. 41: 387. 1918; Firminger, Man. Gard. India, ed. 6, 2: 388. 1918; E. D. Merr., Sp. Blanc. 330. 1918; Gilg in Engl., Syllab. Pflanzenfam., ed. 8, 319 & 369. 1919; Fedde & Schust., Justs Bot. Jahresber. 42: 252. 1930; E. D. Merr., Bibl. Enum. Born. Pl. 512. 1921; Haines, Bot. Bihar Orissa, ed. 1, 4: 704 & 709--710. 1922; Gilg in Engl., Syllab. Pflanzenfam., ed. 9

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Richardson, Fla. Scient. 40: 352. 1977; Babu, Herb. Fl. Dehra Dun 16, 395, & 396. 1977; Batson, Gen. East. Pl. 146, 147, & 188. 1977; Chin, Gard. Bull. Singapore 30: 192. 1977; Clay & Hubbard, Haw. Gard. Trop. Shrubs 186, [187], & 288. 1977; Nishikawa & Nishizawa, Bull. Gov. For. Exp. Sta. Tokyo 298: 1--42. 1977;Poppeton, Shuey, & Sweet, Fla. Scient. 40: 384. 1977; Richardson, Fla. Scient. 40: 307, 310, & 319. 1977; Terrell, U. S. Dept. Agr. Agric. Handb. 505: 24 & 130. 1977; Anon., Roy. Bot. Gard. Kew Lib. Curr. Aware. 9: 23 (1978) and 11: 21. 1978; Heathcote in Haywwod, Flow. Pl. World 237. 1978; Hicks, Stephenson, Fountain, Grimes, & Cox, Woody Pl. West. Gulf Reg. 316--317. 1978; Hsiao, Fl. Taiwan 4: 411 & 413--418. 1978; "J. S. J.", Biol. Abstr. 66: 4474. 1978; Mold., Phytologia 40: 409, 424--436, 468--476, 505 & 511. 1978; Mound & Halsey, Whitefly World 7, 34, 117, 123, 183, 200, 216, 305, & 308. 1978; Mukherjee & Chanda, Trans. Bose Res. Inst. 41: 41, 44, 47, 50, & 57. 1978; Peacock, Exxon USA 17 (3): 5. 1978; Pirone, Diseas. Pests Ornament. Pl., ed. 5, 169. 1978; Sharma, Shetty, Vivekanathan, & Rathakrishnan, Journ. Bomb. Nat. Hist. Soc. 75: 33. 1978; Van den Berghe, Ieven, Mertens, & Vlietinck, Lloydia 41: 464. 1978; Bare, Wildfl. Weeds Kans. 306. 1979; D. E. Clark, Sunset New West. Gard. Book, ed. 4, imp. 2, 213. 1979; Cronquist, How Know Seed Pl. 100, fig. 213C. 1979; Fosberg, Phytologia 41: 363--365. 1979; Fosberg, Sachet, & Oliv., Micronesica 15: 232--234. 1979; Hocking, Excerpt. Bot. A.33: 88 & 90. 1979; Holm, Pancho, Herberger, & Plucknett, Geogr. Atlas World Weeds 60. 1979; Jones & Luchsinger, Pl. Systemat. 301 & 302. 1979; López-Palacios, Revist. Fac. Farm. Univ. Andes 20: 18. 1979; Mold., Phytologia 41: 302, 363, & 505 (1979), 43: 222, 277, & 501 (1979), and 44: 219 & 506. 1979; A. L. Mold., Phytologia 41: 302. 1979; F. Muell., Descr. Notes Pap. Pl., imp. 2, 1: 91 & 110. 1979; Puig, Trav. Sect. Scient. Techn. Inst. Franç. Pond. Hors 16: 38 & 126. 1979; Rogerson, Becker, & Prince, Bull. Torrey Bot. Club 106: 62. 1979; Rogerson, Becker, Long, & Prince, Bull. Torrey Bot. Club 106: 245. 1979; Woolliams, Notes Waimea Arboret. 6: 11. 1979; Avery & Loope, S. Fla. Res. Cent. Rep. T-574: 33. 1980; Bawa, Ann. Rev. Ecol. Syst. 11: 16. 1980; Biswas & Maheshwari, Journ. Bomb. Nat. Hist. Soc. 77: 225. 1980; Byrne, Atoll Res. Bull. 240: 65, 123, & 191. 1980; Craig & Sm., Soil Crop. Sci. Soc. Fla. Proc. 39: 84. 1980; Fosberg, Otobed, Sachet, Oliv., Powell, & Canfield, Vasc. Pl. Palau 38. 1980; Fosberg & Sachet, Smithson. Contrib. Bot. 45: 25--26 & 37. 1980; Hu, Journ. Arnold Arb. 61: 87. 1980; Jiang Han-qiao, Act. Bot. Yun. 2: 29. 1980; Mohlenbrock, Castanea 45: 268. 1980; Mold., Phytologia 45: 40 & 504. 1980; Olmsted, Loope, & Hilsenbeck, So. Fla. Res. Cent. Rep. T.604: 48. 1980; Roxb., Hort. Beng., imp. 2, [10], [36], & [83]. 1980; Seymour, Phytol. Mem. 1: 242. 1980; Mold., Phytol. Mem. 2: 4, 13--17, 19, 21, 25, 26, 32, 38, 40, 41, 46, 48, 60, 69, 70, 73, 75, 77, 78, 80, 83, 85, 87, 88, 91, 93, 94, 97, 99, 104, 107, 114, 127, 132, 173, 247, 248, 252, 254, 257--259, 267, 270, 271, 274--276, 280--284, 288--291, 295, 298--300, 302--306. 309--312, 320--325, 328--330, 334, 340, 345, 346, 376--379, 405, 412, 422, 429, 432, 525--529, & 627. 1980; Thomas, Cox, Dawson, & Gough, Contrib. Herb.

North. La. Univ. 1: 64. 1980; Vogel, Seedl. Dicot. 13, 26, & 92. 1980; Diaconescu, Act. Bot. Hort. Bucurest. 1979/1980: 111--114. 1981; Duncan & Kortesz, Vasc. Fl. Ga. 14 & 111. 1981; Hu, Enum. Chin. Mat. Med. 12, 117, 152, & 218. 1981; Thomas & Allen, Contrib. Herb. North. La. Univ. 2: 6, 38, & 44. 1981.

Mound & Halsey (1978) report that members of this genus are often host to the whitefly, *Bemisia tabaci* (Gennadius) Takahashi, while Pirone (1978) reports them attacked by the leaf-spots, *Atractilina callicarpae* and *Cercospora callicarpae* and a black-mold, *Meliola cookeana,* as well as by the fungi, *Botryosphaeria dothidea, Coniothyrium callicarpae, Nectria cinnabarica,* and *Physalospora obtusa.*

Merrill (1917) asserts that the *Frutex ceramicus* Rumpf is probably a species of *Callicarpa,* and that it has been suggested that *Perlarius alter silvestris* Rumpf may also belong here, although this is more doubtful.

It should be noted that the "L. Gen. Pl. 140", often cited in bibliographies of this genus, actually refers to genus number 140 (*Tomex*) on page 54 of Linnaeus' work. A "Vol. 2, fig. 191" is sometimes cited for this genus in C.K. Schneider's Illustr. Handb. Laubholzk., but this figure depicts a *Rhamnus,* in the *Rhamnaceae,* not a *Callicarpa.*

In passing, it is of interest to note that Reichenbach (1828) classified *Callicarpa* in the *Lamiaceae.* It is also worth noting that Briquet's work (1895) in Engler & Prantl's Die Natürlichen Pflanzenfamilien is date "1894" by Durand & Jackson (1901) in the Index Kewensis, as is also the cover page of the part of the volume herein involved, but Stafleu (1967) asserts that pages 97--224 were not actually published until 1895.

The Baileys (1976) comment that "Callicarpas can be grown in a light place in the greenhouse in a compost of loam and peat. Propagated by cuttings, layers, and seeds. They are raised for both the ornamental flowers and clusters of colored fruits. Those from northerly regions may be hardy in Zone 5 [in North America], and if the tops die back, new shoots usually bloom and fruit."

The *Gibot SAN.30558,* distributed as *Callicarpa* sp., actually is *Geunsia cumingiana* (Schau.) Rolfe, while *Dewol, Leopold, & Shea SAN.71163* and *Sundaling SAN.80243* are *G. farinosa* Blume, *Shea SAN.75611* is *G. furfuracea* (Bakh.) Mold., *Fedilis & Sumbing SAN.88279* is *G. pentandra* (Roxb.) Merr., *Kinted SAN.19065* is *Premna foetida* Reinw., *Sinanggol SAN.57292* is the type collection of *P. oblongifolia* var. *angustata* Mold., *Meijer & Singh SAN.24797* is *P. odorata* Blanco, *Cockburn SAN.83974* and *Muroh SAN.71082* are *P. rotundifolia* Koord. & Val., and *Niyomdham, Suangtho, & Sangkhachand 117* is *P. flavescens* Hamilt.

Additional excluded taxa:

Callicarpa basilanensis Merr. ex Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 16, in syn. 1921 = *Geunsia cumingiana* (Schau.) Rolfe.

Callicarpa bastlanensis Merr. ex Bakh. in Lam & Bakh., Bull. Jard. Bot. Buitenz., ser. 3, 3: 16, in syn. 1921 = *Geunsia cumingiana* (Schau.) Rolfe.

CALLICARPA ACULEOLATA Schau.

Additional bibliography: Mold., Phytologia 40: 425. 1978; Hocking, Excerpt, Bot. A.33: 90. 1979; Mold., Phytol. Mem. 2: 94 & 525. 1980.

CALLICARPA ACUMINATA H.B.K.

Additional bibliography: Schlecht. & Cham., Linnaea 5: 97 (1830) and 6: 372. 1831; Baill., Hist. Pl. 11: 95. 1891; Mold., Phytologia 40: 425--427 & 474. 1978; Mukherjee & Chanda, Trans. Bose Res. Inst. 41: 50. 1978; Puig, Trav. Sect. Scient. Techn. Inst. Franç. Pond. Hors 16: 38 & 126. 1979; Mold., Phytol. Mem. 2: 60, 69, 70, 73, 75, 77, 78, 80, 83, 85, 104, 107, 114, 127, 132, 173, 345, 376, 378, & 525. 1980; F. C. Seymour, Phytol. Mem. 1: 242. 1980.

Recent collectors describe this plant as growing in disturbed areas in secondgrowth scrub, along fencerows of wet roadsides, and in disturbed tropical moist forests with mesquite and *Scheelea*, at 50--1200 m. altitude, describing it as a shrub, 1.5 to 6 m. tall, with "stems in a clump....from a 10 cm. diameter stump, the fruit juicy, turning various shades of purple", and as a weak tree, 8 m. tall, or even as a "tree, 10 m. tall, near edge of stream, the lower branches overhanging the stream", the stems scurfy-tan, the leaves subrugulose above and shiny, and the fruit dark-purple, an anthesis in March, May, November, and December, and in fruit in March, June, and September. They report the vernacular name, "xpucuy". The corollas are said to have been "pale yellowish-white" on *Burger & Gentry 8839* and "white" on *Neill 4176* and *Stevens 4913*. Schlechtendal & Chamisso (1831) describe the corollas as white and the fruit black.

The *Cowan 1919* and *Molina R. & Molina 24733*; distributed as typical *C. acuminata*, actually represent var. *argutedentata* Mold., while *Cavalcante 3018* is *Aegiphila lhotzkiana* Cham.

Additional citations: MEXICO: Veracruz: *Ventura A. 4624* (Ws). Yucatán: *Enriquez 617* (Me--120717). NICARAGUA: Zelaya: *Neill 4176* (Ld); *W. D. Stevens 4913* (Ld). COSTA RICA: Cartago: *Croat 36568* (W--2845848). Puntarenas: *Burger & Gentry 8839* (Go). PANAMA: Colón: *M. Nees 6991* (Au). COLOMBIA: Cundinamarca: *Gentry, Daly, Leon, & Barbosa 18092* (Ld, N). ECUADOR: Esmeraldas: *Madison, Plowman, Kennedy, & Besse 5019* (N).

CALLICARPA ACUMINATA var. *ARGUTEDENTATA* Mold.

Additional bibliography: Mold., Phytologia 40: 426--427. 1978; Mold., Phytol. Mem. 2: 60, 70, 73, 75, & 525. 1980.

Recent collectors describe this plant as a shrub, 2--4 m. tall, and have encountered it as "common" in cutover pine forests and thickets, at 700 m. altitude, in flower in November. The corollas are said to have been "white" on *Cowan 1919* and *Molina R. & Molina 24733*.

Additional citations: MEXICO: Tabasco: *C. Cowan 1919* (Au, N). GUATEMALA: El Petén: *Contreras 2213* (Au). HONDURAS: Copán: *Molina R. & Molina 24733* (W--2865093).

CALLICARPA ACUMINATA var. *PRINGLEI* (Briq.) Mold.
Additional bibliography: Mold., Phytologia 40: 427. 1978; Mold., Phytol. Mem. 2: 60, 69, 376, 378, & 525. 1980.

CALLICARPA ACUTIDENS Schau.
Additional bibliography: Mold., Phytologia 40: 427. 1978; Mold., Phytol. Mem. 2: 290 & 525. 1980.

CALLICARPA ACUTIFOLIA Chang
Additional bibliography: Mold., Phytologia 33: 382. 1976; Mold., Phytol. Mem. 2: 275 & 525. 1980.

CALLICARPA ALBIDO-TOMENTELLA Merr.
Additional bibliography: Mold., Phytologia 40: 427. 1978; Mold., Phytol. Mem. 2: 305 & 525. 1980.
Merrill (1923) cites only the type collection, stating that this endemic Philippine species grows in forests along small streams at low altitudes.

CALLICARPA ALONGENSIS Dop
Additional bibliography: Mold., Phytologia 33: 383. 1976; Mold., Phytol. Mem. 2: 291 & 525. 1980.

CALLICARPA AMERICANA L.
Additional synonymy: *Callicarpa americanus* L., in herb. *Collicarpa americana* L., in herb.
Additional & emended bibliography: G. Don in Sweet, Hort. Brit., ed. 3, 550. 1839; A. Gray, Synop. Fl. N. Am., ed. 1, 2: 340 (1878) and ed. 2, 2: 340. 1886; Baill., Hist. Pl. 11: 95. 1891; Briq. in Engl. & Prantl, Nat. Pflanzenfam., ed. 1, 4 (3a): 134 & 166. 1895; Quaintance, Canad. Ent. 31: 4. 1899; C. K. Schneid., Illustr. Handb. Laubholzk. 591 & 592, fig. 384 f & g. 1911; E. D. Merr., Sp. Blanc. 330. 1918; Stapf, Ind. Lond. 1: 525 (1929) and 6: 539. 1931; Bedevian, Illustr. Polyglott. Dict. 132. 1936; Alain in León & Alain, Fl. Cuba. imp. 1, 4: 304 & 306. 1957; Russell, Ann. Ent. Soc. Am. 56: 151. 1963; Serbanescu-Jitariu & Mitroiu, Act. Bot. Hort. Bucurest. 1972-73: 106--109, pl. 1, fig. 1. 1973; Marx & Thomas, Proc. La. Acad. Sci. 38: 85. 1975; L. H. & E. Z. Bailey, Hortus Third 201. 1976; Austin, Coleman-Marois, & Richardson, Fla. Sci. 40: 352. 1977; Batson, Gen. East. Pl. 147. 1977; Clay & Hubbard, Haw. Gard. Trop. Shrubs 186, [187], & 288. 1977; Poppeton, Shuey, & Sweet, Fla. Scient. 40: 384. 1977; Richardson, Fla. Scient. 40: 307, 310, & 319. 1977; Terrell, U. S. Dept. Agr. Agric. Handb. 505: 24 & 130. 1977; Hicks, Stephenson, Fountain, Grimes, & Cox, Woody Pl. West. Gulf Reg. 316--317. 1978; Mold., Phytologia 40: 427--429. 1978; Mound & Halsey, Whitefly World 200 & 216. 1978; Peacock, Exxon USA 17 (3): 5. 1978; Van den Berghe, Ieven, Mertens, & Vlietinck, Lloydia 41: 464. 1978; Cronquist, How Know Seed Pl. 100, fig. 213C. 1979; Holm, Pancho, Herberger, & Plucknett, Geogr. Atlas World Weeds 60. 1979; Jones & Luchsinger, Pl. System. 302. 1979; A. L. Mold., Phytologia 41: 302. 1979; Avery & Loope, S. Fla. Res. Cent. Rep. T-574: 33. 1980;

Craig & Sm., Soil Crop. Sci. Soc. Fla. Proc. 39: 84. 1980; Mohlenbrock, Castanea 45: 268. 1980; Mold., Phytol. Mem. 2: 13--15, 17, 19, 21, 25, 26, 32, 38, 40, 41, 46, 48, 60, 85, 87, 91, 345, & 525. 1980; Olmsted, Loope, & Hilsenbeck, S. Fla. Res. Cent. Rep. T-604: 48. 1980; Duncan & Kortesz, Vasc. Fl. Ga. 111. 1981; Thomas & Allen, Contrib. Herb. North. La. Univ. 2: 6 & 44. 1981.

Additional & emended illustrations: C. K. Schneid., Illustr. Handb. Laubholzk. 592, fig. 384 f & g. 1911; Bedevian, Illustr. Polyglott. Dict. 132. 1936; Serbanescu-Jitariu & Mitroiu, Act. Bot. Hort. Bucurest. 1972-73: 109, pl. 1, fig. 1. 1973; Batson, Gen. East. Pl. 147. 1977; Clay & Hubbard, Haw. Gard. Trop. Shrubs [187] (in color). 1977; Hicks, Stephenson, Fountain, Grimes, & Cox, Woody Pl. West. Gulf Reg. 316 & 317. 1978; Peacock, Exxon USA 17 (3): 5 (in color). 1978; Cronquist, How Know Seed Pl. 100, fig. 213C. 1979.

Recent collectors describe this species as a small shrub, "after 6 years less than 1 m. tall", with medium branching, the fruit violet, lavender, or purple. They have encountered it in moist upland soil, at the edges of granite outcrops, in sandy soil of moist woods, and in the pine-hickory-oak ecologic community, flowering in June and September, fruiting in September and October. Some leaves on *Thomas & Bot. 451 Class 8916* measure 26 by 14.5 cm. Mohlenbrock (1980) lists it from Berkeley and Charleston Counties in South Carolina.

Serbanescu-Jitariu & Mitroiu (1973) describe the pollen of this species, on the basis of *Herb. Univ. Cluj 147196,* as follows: "prolat; 3-colporat; vazut apical 39--54 mu in diam., din profil înalt 46,8--57,2 mu, lat 31,2--36,4 mu. Polenul scuturat din antere şi văzut cu ochiul liber este galben, în apa, la microscop este galben portocaliu, în chloralhidrat, galben verzui. Sporoderma cu o grosime de 2,6 mu prezintă exina crassisexinată cu o structură simpilată in sectiune optică respectiv retipilată; suprafaţa sporodermei reticulata cu muri (peretii) groşi."

Bedevian (1936) lists several additional common or vernacular names for this species: "callicarpa d'America", "callicarpe", "fenk tutu", "porphyra", and "tât fransâ".

Van den Berghe and his associates (1978) found this species to contain principles with antiviral activity against polio, coxsackie, semliki-forest, adeno, herpes, and measles.

Russell (1963) reports this species often infested by the whitefly, *Trialeurodes packardi* (Morrill) Quaint. & Bak., while Quaintance (1899) adds another species, *Tetraleurodes mori* (Quaint.) Quaint. & Bak.

Material of *Callicarpa americana* has been misidentified and distributed in some herbaria as *Symphoricarpos vulgaris* Michx. and as *Viburnum dentatum* L. *Thomas & Rhodes 38892* is identified by the collectors as f. *lactea* (F. J. Muller) Rehd., but since the specimen was collected during only anthesis, it is not evident how the collectors knew that it was this white-fruited form, unless, of course, they had marked the individual plant during the previous season while it was in fruit. In this case it would be most interesting to compare the flowers with those of the normal form for

signs of albinism.

Additional citations: VIRGINIA: York Co.: *Kirkman 265* (Ne--144021). NORTH CAROLINA: Jones Co.: *Sears C.375* (Ne--33479). New Hanover Co.: *Sieren 341* (Ne--88342). Pender Co.: *Sieren 1389* (Ne--124966). SOUTH CAROLINA: Florence Co.: *Rodgers, Compton, Green, & Hudson 73434* (Ne--83608). Jasper Co.: *Leonard & Radford 1931* (Ne--33484). GEORGIA: Cobb Co.: *Piehl 64126* (Ne--79205). DeKalb Co.: *Pyron & McVaugh 373* (Au). Houston Co.:*Dixon 1449* (Ne--161849). McIntosh Co.: *D. S. Correll 5442* (Au). Oglethorpe Co.: *Blake & Montgomery 179* (Ne--144448), *217* (Au, Ne--144449). FLORIDA: Calhoun Co.: *Pearman & Odenwelder 73-433* (Ne--82287). Dade Co.: *M. J. Murray s.n.* [Cutler, June 21, 1937] (Ne--119020, Ne--119031). Palm Beach Co.: *Cassen 419* (Ne--59934); *Guzman 31* (Ne--172771, Ne--175619). Polk Co.: *Jennings & Jennings s.n.* [July 5--31, 1934] (Go). Key Largo: *Lassetter 2230* (Ne--167511). ALABAMA: Lee Co.: *Hayden 74* (Ne--172961). Randolph Co.: *R. Kral 28828* (Ne--107011). Dauphin Island: *Taylor & Taylor 13526* (Ne--104579). MISSISSIPPI: Holmes Co.: *Whitam 669* (Ne--461). Simpson Co.: *Painter 326* (Ne--92325); *Wallus & Heard s.n.* [2 September 1971] (Ne--69869); *Wallus & Wallus s.n.* [12 Sept. 1971] (Ne--72022). Warren Co.: *Thomas & al. 24134* (Ne--59577). ARKANSAS: Ashley Co.: *Barrett s.n.* [3 August 1969] (Ne--59549). Cleburne Co.: *Lawson & Bio. 451 Class 1051* (Ne--74756). Columbia Co.: *Knesel & Knesel s.n.* [August 4, 1972] (Ne--62223). Hempstead Co.: *Lawson 1758* (Ne--90568). Howard Co.: *Lawson 1568* (Ne--917650), *1837* (Ne--90356). Independence Co.: *Thomas & Bio 451 Class 8916* (Ne--33482), *8985* (Ne--33483), *15912* (Ne--56259). Izard Co.: *Lawson & Pate 727* (Ne--75689); *Thomas & Bio. 451 Class 8668* (Ne--33481), *16247* (Ne--33486); *Thomas & family 45978* (Ne--110766); *Thomas & Gray 9187* (Ne--33487). Jefferson Co.: *Thoma, Click, & Click 44040* (Ne--110105). Montgomery Co.: *Lawson & Henze s.n.* [24. Sept. 1977] (Ne--138797). Ouachita Co.: *Spencer & Spencer 93* (Ne--78879). Prairie Co.: *J. Gray s.n.* [7.7.68] (Ne--33489). Sevier Co.: *Demaree 54083* (Ne--66221). Stone Co.: *Thomas & Bio. 451 Class 10531* (Ne--33488), *15519* (Ne--33485). Union Co.: *Scarbrough & Hux 688* (Ne--28862). LOUISIANA: Allen Par.: *Thomas & al. 29946* (Ne--63815). Beauregard Par.: *Roper & Seale 181* (Ne-33470). Bienville Par.: *Moreland 247* (Ne--117927); *Thomas & al. 23554* (Ne--33425). Bossier Par.: *Darwin & Sundell 1739* (Ne--177816); *Leggett & Leggett 5* (Ne--123021); *Thomas, Leggett, & Balogh 48658 & 1220* (Ne--119680). Caddo Par.: *Overby 4* (Ne--77087), *232* (Ne--81171); *Raymond 148* (Ne--117619). Calcasieu Par.: *Hendershot 6* (Ne--123681); *Mistretta 73* (Ne--33424); *Rope & Seale 161* (Ne--33467); *Thomas & al. 14410* (Ne--33468), *14443* (Ne--33464). Caldwell Par.: *Marx & Raymond 130* (Ne--110887); *Scarbrough & Scarbrough 521*(Ne--33473); *Shell 2* (Ne--33472); *Thomas & Bot. 311 Class 49337* (Ne--122468); *Thomas, Thomas, & Gilliam 2937* (Ne--33446). Catahoula Par.: *French 394* (Ne--104413); *French & Laird 263* (Ne--122592); *R. D. Thomas 44653* (Ne--109502); *Thomas & Bot. 311 Class 10934* (Ne--33434); *Thomas, DePoe, Barrett, & Stegall 1993* (Ne--33449); *Thomas, Montgomery, Barrett, & Cicala 3928* (Ne--33438); *Thomas & Overby 18975* (Ne--33428). Claiborne Par.: *L. Lewis 2760*

(Ne--174911); *L. G. Lewis 459* (Ne--130465); *Lewis & Rich 767* (Ne-133150); *Thomas, Brode, Smith, & Renfrow 4811* (Ne--33455). DeSoto Par.: *R. D. Thomas 45471* (Ne--109666); *Thomas & Dixon 61303 & 207* (Ne--148604). East Baton Rouge Par.: *C. A. Brown 808* (Ne--118790). East Carroll Par.: *Thomas & McCoy 68068 & 380* (Ne--168972). East Feliciana Par.: *Thomas & al. 11477* (Ne--33432), *61966* (Ne--150737). Evangeline Par.: *Cormier 569* (Ne--153012); *Hamlin 101* (Ne--74786); *Thomas, Cormier, & Pias 55480 & 65 & 1999* (Ne--134615); *Thomas & Rhodes 38721* (Ne--89295). Franklin Par.: *Fletcher & Fletcher 52* (Ne--147374); *Thomas, Jones, & Stegall 2207* (Ne--33442). Grant Par.: *J. W. Parker 77* (Ne--66475); *Thomas, Barrett, Gremillion, & Cicala 3074* (Ne--33445); *Thomas, Barrett, & Jones 1035* (Ne--33443). Iberia Par.: *Thomas & al. 31022* (Ne--64125). Jackson Par.: *Reid & al. 1583* (Ne--69576); *Reid & Reid 1454* (Ne--33462), *1834* (Ne--33426), *1902* (Ne--33427), *2100* (Ne--69575); *Reid, Reid, & Scarbrough 977* (Ne--33475); *Thomas & Bot. 311 Class 10709* (Ne--33433); *Thomas & Jones 3429* (Ne--33447); *Thomas & Reid 16685* (Ne--33463). Lafayette Par.: *Lasseigne & Lackey 4737* (Ne--118817). LaSalle Par.: *Laird 894* (Ne--126923). Lincoln Par.: *Thomas, Pias, & Dawson 58411* (Ne--142474). Livingston Par.: *Montz 1822* (Ne--2766); *Thomas & al. 11865* (Ne--33429). Madison Par.: *R. Jones 236* (Ne--86585); *Thomas & Rich 58822 & 945* (Ne--143672); *Thomas, Rich, & Dawson 56167 & 542* (Ne--137433). Morehouse Par.: *R. D. Thomas 16858* (Ne--33469); *Thomas & al. 28800* (Ne); *Thomas & Pias 49730 & 210* (Ne--124268), *58115 & 3190* (Ne--141381), *59044 & 3620* (Ne--143301); *Thomas & Scarbrough 16816* (Ne--33461); *Thomas, Thomas, & Thomas 1447* (Ne--33453). Natchitoches Par.: *Nixon s.n.* [Sept. 1968] (Ne--33421). Ouachita Par.: *Colvin & Colvin 1* (Ne--90836); *Scarbrough & Scarbrough 504* (Ne--33474); *C. Smith 1438* (Ne--30708); *R. D. Thomas 33* (Ne--33451, Ne--33452), *2836* (Ne--33448); *Thomas & al. 45927* (Ne--111999); *Thomas & Bot. 311 Class 11272* (Ne--33435), *29703* (Ne--60121); *Thomas, Thomas, & Thomas 729* (Ne--33444); *Whitam T.110*(Ne--33465), *T.137* (Ne--33457), *T.238* (Ne--33458); *Whitam, Thomas, Barrett, & Gremillion 3* (Ne--3345). Rapides Par.: *S. Schutz 1553* (Ne--154835); *S. E. Schutz 1745* (Ne-156757); *Schutz & Schutz 554* (Ne--134699), *696* (Ne--132134), *1481*(Ne--154957); *Schutz, Schutz, Talbot, & McCoy 163* (Ne); *R. D. Thomas 5333* (Ne--33440), *5353* (Ne--33441); *Thomas & Rhodes 38892* (Ne--114435). Red River Par.: *R. D. Thomas 5742* (Ne--33436); *Thomas & Kee 44962* (Ne--110622). Richland Par.: *Dawson & Dawson 595* (Ne--133255); *Thomas & Dawson 58556 & 1424* (Ne--142035); *P. White 18* (Ne--82932), *102* (Ne--80777). Sabine Par.: *Carroll & Hutchinson 26* (Ne--165787); *K. Scarbrough s.n.* [June 20, 1970] (Ne--33476); *R. D. Thomas 5648* (Ne--33437), *25816* (Ne--33423). Saint Helena Par.: *Thomas & al. 11587* (Ne--33431), *32690* (Ne--64090). Saint Martin Par.: *Lewis, Rich, & McCoy 2358* (Ne--162955). Saint Mary Par.: *Dooley 152* (Ne--73647, Ne--74648), *229* (Ne--69513), *390* (Ne--70220); *Thomas, Reid, Smith, & Dooley 27001* (Ne--69701). Saint Tammany Par.: *R. D. Thomas 46318* (Ne--112948); *Thomas & al. 35601* (Ne--78685), *49552* (Ne--124425). Tangipahoa Par.: *Thomas & al. 32642* (Ne--63416), *40363* (Ne--90860), *66378* (Ne--161392). Tensas Par.: *Briley & Rich 801* (Ne--

168636); *James 59* (Ne--33466); *Thomas & Briley 69633 & 854* (Ne--168814. Terrebonne Par.: *Guidroz 78* (Ne--80276). Vernon Par.: *R. D. Thomas 5570* (Ne--33439), *74012* (Ne--180362); *Thomas & Grelen 71871* (Ne--175848). Washington Par.: *C. Smith 616* (Ne--76621); *R. D. Thomas 63426* (Ne--157353); *Thomas & al. 12462* (Ne--33460), *14183* (Ne--33459). Webster Par.: *Braley & Braley s.n.* [21 Sept. 1968] (Ne--33471); *Knesel & Pope s.n.* [7 Aug. 1971] (Ne--33420); *R. D. Thomas 72038* (Ne--173343); *Thomas, Smith, Vrode, & Renfrow 5052* (Ne--33454). West Carroll Par.: *Crews s.n.* [24 September 1972] (Ne--63053); *Gough 410* (Ne--156053); *Thomas & Gough 51277 & 152* (Ne--156054); *Thomas & Spencer 35042* (Ne--81630). West Feliciana Par.: *Thomas & al. 11420* (Ne--33430), *35718* (Ne--78799), *61897* (Ne--151551). Winn Par.: *Hutchinson & Carroll 32* (Ne--168479); *Middlebrooks 3* (Ne--13466); *R. D. Thomas 60331* (Ne--151617); *Thomas, Kessler, & Ricks 72607 & 316* (Ne--178240). Cote Blanche Island: *Thomas, Dooley, & al. 28331* (Ne--67131). TEXAS: Cass Co.: *Marx 1385* (Ne--85279). Galveston Co.: *Waller & Bauml 2982* (Au). Gonzales Co.: *D. S. Correll 20462* (N). Gregg Co.: *R. D. Thomas 24939* (Ne--72949). Harris Co.: *Reid & Scarbrough 2048* (Ne--61359). San Jacinto Co.: *Higgins 5497* (Au). Smith Co.: *Wilkinson 337* (N), *851* (N). Travis Co.: *McKinney 34* (Ld). Trinity Co.: *Thomas & Barrett 4446* (Ne--33480). Walker Co.: *Kessler 3773* (Ne--184566); *Thomas, Marx, & Allen 39638* (Ne--92683). CULTIVATED: Zimbabwe: *J. Scott s.n.* [South. Rhodes. Govt. Herb. 263464] (N).

CALLICARPA AMERICANA f. *LACTEA* (F. J. Muller) Rehd.

Additional bibliography: L. H. & E. Z. Bailey, Hortus Third 201. 1976; Clay & Hubbard, Haw. Gard. Trop. Shrubs 186 & 288. 1977; Mold., Phytologia 40: 429. 1978; Duncan & Kortesz, Vasc. Fl. Ga. 111. 1981; Thomas & Allen, Contrib. Herb. North. La. Univ. 2: 6. 1981

The *Thomas & Rhodes 38892,* cited under typical *C. americana* L., was identified by the collectors as f. *lactea,* but since it is only in flower the evidence for this identification is not obvious, unless, of course, the collection was made from a bush tagged the previous year when it was in fruit. It this case, it would be of interest to examine for evidence of floral albinism.

Lars Johnson, in the summer of 1980, found this white-fruited form of the species growing along with the normal form, with no evidence of intergradation, at Alligator Lake, Osceola County, Florida, and has kindly given me a splendid color photograph of the plant in situ.

Additional citations: LOUISIANA: DeSoto Par.: *Thomas, Dixon, & Briley 68222 & 1892* (Ne--164317). LaSalle Par.: *Wroten 767* (Ne--33477). Natchitoches Par.: *Nixon s.n.* [Sept. 1968] (Ne--33422), *s.n.* [11-1-68] (Ne--33456). Saint Tammany Par.: *Thomas & Botany 403 Class 46216* (Ne--113038). Union Par.: *Dixon, Briley, & Bot. 414 Class 4604* (Ne--179939). Winn Par.: *R. D. Thomas 74460* (Ne--181154).

CALLICARPA AMPLA Schau.

Additional bibliography: Stahl, Estud. Pl. Puerto Rico, ed. 1,

3: 299--300 & 340. 1888; Urb., Symb. Antil. 4: 536. 1911; Stahl, Estud. Fl. Puerto Rico, ed. 2, 3: 299--300. 1937; Mold., Phytologia 40: 429. 1978; Mold., Phytol. Mem. 2: 97, 99, & 525. 1980.

Urban (1911) cites for this species from Puerto Rico the following collections in the Berlin herbarium (now destroyed):*Schwanecke s.n., Sintenis 2066, 2143, 2165, 4530,* & *4583, Stahl 269,* and *Wydler s.n.*

Additional citations: PUERTO RICO: *Woodbury s.n.* [Oct. 15, 1968] (N).

CALLICARPA ANGUSTA Schau.

Additional & emended bibliography: Fern.-Villar in Blanco, Fl. Filip., ed. 3, 4: 158. 1880; Vidal y Soler, Phan. Cuming. Philip. 51 & 134. 1885; E. D. Merr., Philip. Journ. Sci. 7: 340 & 341. 1912; E. D. Merr., Enum. Philip. Flow. Pl. 3: 382 & 387. 1923; Mold., Phytologia 40: 429. 1978; Mold., Phytol. Mem. 2: 305 & 525. 1980.

Merrill (1912, 1923) cites from the Philippine Islands the following collections: Luzon: *Ahern's Collector PFB.1888, Cuming 1425, Hallier s.n., Ramos PBS.1030, 39455,* & *39497, Ramos & Edaño PBS. 26367* & *34051.* Mindoro: *Merritt PFB.8878.* He states that the species inhabits thickets and secondary forests at low altitudes and that it is there endemic.

CALLICARPA ANGUSTIFOLIA King & Gamble

Additional & emended bibliography: Fletcher, Kew Bull. Misc. Inf. 1938: 404, 407, 412, & 413. 1938; Mold., Phytologia 40: 429. 1978; Mold., Phytol. Mem. 2: 284, 295, 298, 311, 320, & 525. 1980.

Maxwell describes this plant as a shrub, 1--2 m. tall, the calyx greenish, the petals pinkish, and the fruit at first green, later turning maroon, and encountered it in open areas on limestone talus, flowering and fruiting in April.

Additional citations: MALAYA: Perak: *Maxwell 78-122* (Ac).

CALLICARPA ARBOREA Roxb.

Additional & emended bibliography: Roxb., Hort. Beng., imp. 1, [10]. 1814; Pers., Sp. Pl. 1: 343. 1817; G. Don in Sweet, Hort. Brit., ed. 3, 550. 1839; Brandis, Forest Fl. N.W. Cent. India 3: 368--369. 1874; K. Schum. & Hollr., Fl. Kais. Wilhelmsl. 119. 1889; K. Schum. & Lauterb., Fl. Deutsch. Südsee Schutzgeb. 521. 1900; Haines, Bot. Bihar Orissa, ed. 1, 4: 709. 1922; E. D. Merr., Enum. Philip. Flow. Pl. 3: 386. 1923; Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 1, 3: 1920, pl. 732a. 1935; Fletcher, Kew Bull. Misc. Inf. 1938: 401 & 411--413. 1938; Metcalfe & Chalk, Anat. Dicot. 2: 1036, fig. 248 D. 1950; Haines, Bot. Bihar Orissa, ed. 2, 2: 743--744. 1961; Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 2, 3: pl. 732a. 1975; Mold., Phytologia 40: 429--431 & 473. 1978; Biswas & Maheshwari, Journ. Bomb. Nat. Hist. Soc. 77: 225. 1980; Jiang Han-qiao, Act. Bot. Yun. 2: 29. 1980; Mold., Phytol. Mem. 2: 257, 258, 270, 271, 274, 275, 284. 288, 291. 295, 298, 305, 311, 325, 345, 378, 379, & 525. 1980; Roxb., Hort. Beng., imp. 2, [10]. 1980.

Additional illustrations: Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 1, 3: pl. 732a. 1935; Metcalfe & Chalk, Anat. Dicot. 2: 1036, fig. 248 D. 1950; Kirtikar & Basu, Indian Med. Pl., ed. 2, imp. 2, 3: pl. 732a. 1975.

Recent collectors have found this plant growing on savannas, in deciduous forests, and in scrub, at 10--900 m. altitude.

Schumann & Hollrung (1889) cite *Hollrung 525* from New Guinea, commenting that the species is found "Auf der Ostseite des Himalaya im Terai häufig, dann in Malacca, bis nach Sumatra....Bisher ist dieser Art weder von Australien noch von Neu Guinea bekannt geworden. Sie ist von den Verwandten gut zu unterscheiden." Schumann & Lauterbach (1900) also cite *Hollrung 525*, but add *Lauterbach 1200, Lewandowsky 10,* and *Rodatz & Klink 188*, describing the corollas as red. They report finding it in flower in February and August, in fruit in February.

Fletcher (1938) notes that the type collection of the species is from Chittagong in Bangladesh and lists the species from India, Yünnan, Indochina, and Malaya, citing *Collins 1251, Haniff & Nur 3824, Kerr 182, 691, 7887, 11326, 13887,* & *16419, Kloss 685l, Put 48* & *4112,* and *Vanpruk 321* & *745* from Thailand. For the so-called var. *villosa* (Roxb.) King & Gamble he notes that the type is from Silhet and that the variety grows also in Malaya, citing *Hosseus 618* and *Lakshnakara 838* from Thailand. He distinguishes the variety as follows: Leaves at least 2 1/2 times as long as wide, apically tapering-acuminate, basally long-acute or cuneate..... *C. arborea;* leaves generally 1 1/2 times or at most twice as long as wide, apically caudate-acuminate, basally almost round and then slightly decurrent into the petiole.....*C. arborea* var. *villosa*.

CALLICARPA ARBOREA var. *OBLONGIFOLIA* Kanjilal

Additional bibliography: Mold., Phytologia 33: 391. 1976; Mold., Phytol. Mem. 2: 258 & 525. 1980.

CALLICARPA ARBOREA var. *PSILOCALYX* (H. J. Lam) Mold.

Additional & emended bibliography: Fern.-Villar in Blanco, Fl. Filip., ed. 3, 4: Nov. App. 158. 1880; Vidal y Soler, Phan. Cuming. Philip. 43 & 134. 1885; Mold., Phytologia 40: 430--431. 1978; Mold., Phytol. Mem. 2: 305, 379, & 525. 1980.

CALLICARPA AREOLATA Urb.

Additional & emended bibliography: Alain in León & Alain, Fl. Cuba, imp. 1, 4: 305 & 309. 1957; Mold., Phytologia 33: 391. 1976; Mold., Phytol. Mem. 2: 87 & 525. 1980.

CALLICARPA AUSTRALIS Koidz.

Additional bibliography: Mold., Phytologia 40: 431. 1978; Mold., Phytol. Mem. 2: 300, 302, & 525. 1980.

CALLICARPA BARBATA Ridl.

Additional bibliography: Steenis, Blumea 15: 149. 1967; Mold., Phytologia 33: 392 & 481. 1976; Mold., Phytol. Mem. 2: 311 & 525. 1980.

[to be continued]

A NEW SPECIES OF BLUE COHOSH (CAULOPHYLLUM, BERBERIDACEAE) IN EASTERN NORTH AMERICA

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Our revision of the genus Caulophyllum Michaux has resulted in the recognition of three species. In preparation for a later publication, the following taxonomic and nomenclatural change is proposed.

Caulophyllum giganteum (Farw.) Loconte & Blackwell, comb. & status nov.
Basionym: Caulophyllum thalictroides (L.) Michx. var. giganteum Farw.
Original description: Farwell, O. A. 1918. Notes on the Michigan Flora. Michigan Academy of Sciences Report 20: 178.
Holotype: U.S.A., Michigan, Oakland Co., Farmington Twp., Stevens, 1917, Farwell 4450 (BLH 38877!).

Caulophyllum giganteum is sympatric with C. thalictroides (sensu stricto) in mesophytic forests of eastern North America. Caulophyllum giganteum occurs in Ohio, Kentucky, Tennessee (Sullivan Co.), North Carolina (Alleghany Co.), Virginia, West Virginia, Pennsylvania, New York, Massachusetts, Vermont, New Hampshire (Grafton Co.), and Michigan (southeast), as well as Canada (Ontario and Quebec) where it is most common.

The two species have separate yet overlapping floral phenologies which allow effective temporal reproductive isolation. At a given site, Caulophyllum giganteum will begin to flower two weeks before C. thalictroides; the latter will continue flowering two weeks after C. giganteum. Caulophyllum giganteum has larger flowers correlated with fewer flowers per inflorescence. It has larger carpels, styles, filaments, petals and sepals than C. thalictroides. The leaves and leaflets are also larger than those of C. thalictroides. However, C. thalictroides is taller than C. giganteum. Pigmentation of the petaloid sepals is not as clear-cut as originally described by Farwell. The sepals of C. giganteum are typically purple whereas C. thalictroides may have sepals which are yellow, purple, bichromatic (yellow-purple) or green, all within a single population.

The third species of Caulophyllum, C. robustum Maximowicz, is geographically isolated in eastern Asia.

COLOMBIAN TUBER BEARING SOLANUMS IN THE CONICIBACCATA SERIES

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In recent years several tuber-bearing Solanums have been added to the Colombian flora (C. Ochoa: in Biota Vol. 11 Nr. 90:221-223, 1978 and in Phytologia Vol. 46 Nr. 7:495-497, 1980). At the present time I would recognize the following species for the country: Series Juglandifolia: Solanum juglandifolium Dun., S. ochranthum Dun. Series Conicibaccata: S. colombianum Dun., S. cacetanum Ochoa, S. flahaultii Bitt., S. garcia barrigae Ochoa, S. moscopanum Hawkes, S. orocense Ochoa, S. sucubunense Ochoa and S. cuatrecasasii Ochoa proposed here as a new species. Series Tuberosa: Solanum andreanum Baker and S. lobbianum Bitt. Series Piurana: Solanum tuquerrense Hawkes.

Both, Solanum flahaultii from Colombia and the Peruvian species S. dolichocremastrum Bitt. have erroneusly been considered by Hawkes (Annual Report, Scottish Plant Breeding Station Record, 1963, p. 111) to be synonymous with the Ecuadorian species S. paucijugum. However, these three species are quite different, as already shown by Correll (The Potato and its wild relatives, 1962, pp. 188-193 and 326-328). Solanum flahaultii has small anthers, a small calyx, a long light green conic fruit with an acute apex, while S. dolichocremastrum has larger anthers and calyx, round or globose fruit, as well as a peculiar leaf shape which distinguishes the species as a member of series Megistacroloba. Moreover, according to the counts I have made, S. flahaultii has 2n=4x=48 chromosomes while S. dolichocremastrum has only 2n=2x=24 chromosomes

Other diferences between Solanum paucijugum and S. flahaultii are also striking. In S. paucijugum the leaves have 5-7(-9) leaflets with several interstitial leaflets and the pedicel is articulated near the middle of its length. Also the fruit is ovoid, apically obtuse and green with darker green blotches. In contrast, S. flahaultii has leaves with 3-5(-7) leaflets with zero to 3 interstitial leaflets and pedicel articulation near the calyx, far above the middle of its length.

In addition, the Ecuadorian species Solanum pichinchense Bitt. et Sodiro, should not be considered synonymous with the Colombian S. andreanum, as Hawkes has already pointed out (op. cit. p. 140). S. pichinchense belongs to the series Conicibaccata and has 2n=4x=48 chromosomes, while S. andreanum belongs to the series Tuberosa and has 2n=2x=24 chromosomes. Obviously the species differ in morphology and should be maintained separate.

The following new tuber-bearing species is described here:

SOLANUM CUATRECASASII Ochoa, sp. nov.

Herbaceum, tuberiferum, 40-50 cm vel plus altum. Caules simplice vel ramificati, ad basim 3-4 mm crassi, glabri vel sparse pilis obtecti, anguste alati, alae rectae, internodia 6-10 cm longa. Folia imparipinnata, paucidissecta, bijuga, foliola interjecta nulla. Foliola 6.0-9.0 x 5.0-7.0 cm usque ad 16.5-20.0 x 12.0-13.0 cm: petioli 7 cm vel plus longi, glabri. Foliola late elliptico-lanceolata, conspicue acuminata, supra sparsim pilosa vel glabrescentia, subtus glabra. Foliolum terminale lateralibus paulo majus 5.5-9.5 x 2.1-4.0 cm apice apice longe acuminatum, basi cuneatum. Foliola primi jugis 6.8-7.5 x 2.8-3.0 cm basi rotundata vel modice oblicua petioluli usque ad 6 mm longi: foliola secundi jugis 4.5-5.3 x 1.2-2.0 cm, petiolulus usque ad 8 mm longus. Folia pseudo stipulacea anguste falcata, subfalcata vel asymmetrice elliptico-lanceolata, perangusta, 5-8 x 1.5-2.5 mm. Inflorescentia nunc terminalis, nunc lateralis, cymosa vel cymosa paniculata, 4-7 flora: pedunculus 6 cm longus, ad basim 1 mm crassus, glabrus tamquam pedicelli et calyx; pedicelli in medium vel paulo subtus articulati, pedicellus inferior 7-8 mm longus, superior 8-9 mm longus. Calyx 4.0-4.5 mm longus, lobi anguste elliptico-lanceolati, acuminati, acumina peranguste acuta, fere filiformia, 1 mm vel plus longa. Corolla rotata vel subpentagona, lilacina vel albida, 2.0-2.5 cm diam., antherae basi cordatae, anguste lanceolatae 4 mm longae, filamente plus minusve 1 mm longa, albo-hyalina, sparse pilosa: stylus filiformis, 7 mm longus, 1.0-1.5 mm exsertus, usque ad 1/3 altitudinis sparse papillosus; stigma parvum, ovale, styli apice manifeste paulo crassius. Ovarium longum, conicum. Frutus longi conici 2.0-2.5 cm longi, basi 0.7-1.2 cm crassi, apice acuti.

Species ad seriem Conicibaccata pertinet

HOLOTYPUS: US, National Herbarium Nr. 2339630.

ISOTYPUS: Herbarium Ochoanum.

COLOMBIA: Magdalena, Sierra de Perija, eastern of Manaure, from Floridablanca to El Cinco, 2600 m alt. Coll.: J. Cuatrecasas

and R. Romero Castaneda Nr. 25279, Nov. 13, 1959.

I name this species in honor of Dr. Jose Cuatrecasas. His outstanding contributions to the South American flora will always be permanent landmarks in the botanical science.

Key for the Colombian Conicibaccata series

1. Plants warf, less than 15 cm in height, rosette type at the base ..... S. garcia-barrigae
1. Plants erect or scandent more than 0.30 m to near 2 m in height not rosette type at the base.
2. Flowers small, usually 15-25 mm in diameter rarely up to 30 mm. Articulation of the pedicel near its middle, slightly above or slightly below the middle.
3. Corolla rotate or rotate pentagonal but not appearing to be 10-lobulate, varying in color.
4. Flowers white tinged with blue, mauve or light purple.
5. Leaves with 7-9 leaflets and several interstitial leaflets, sessile or shortly petiolulate..... S. colombianum.
5 Leaves with 3-5 leaflets, no interstitial leaflets, strikingly petiolulate ..... S. cuatrecasasii
4. Flowers pure white, never tinged.
6. Leaves subcoriaceus, sparsely pilose, 9-11 leaflets, largely petiolulate. Leaflets elliptic-lanceolate, apex acute or shortly acuminate..... S. cacetanum.
6. Leaves soft, velutinous: 7-9 leaflets subsessils. leaflets very narrowly elliptic-lanceolate, apex conspicuously acuminate .... S. orocense.
3. Corolla rotate-pentagonal appearing to be 10-lobulate, always blue. ..... S. moscopanum
2. Flowers larger, usually more than 30 mm in diameter. Articulation of the pedicel well above its middle commonly within 5-7 mm of the calyx.
7. Plants finely pubescent throughout. Leaves with 3-5 leaflets. Terminal leaflet much larger than the lateral ones, elliptic-lanceolate.
8. Anthers elliptic-lanceolate, short 3-4 mm long ..... S. flahaultii
8. Anthers narrowly lanceolate, larger,

5-6 mm long..... S. sucubunense

7. Plants sparsely pubescent. Leaves with 5-7 leaflets. Terminal leaflet slightly larger than the lateral ones, broadly elliptic to suborbicular ..... S. sucubunense

STUDIES IN THE EUPATORIEAE (ASTERACEAE). CCXI.

THREE NEW SPECIES OF *MIKANIA* FROM BRASIL.

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The present paper provides descriptions for three new species that are to be added to the more than 160 species of *Mikania* already known from Brasil (Barroso, 1958; King & Robinson, 1980, 1981).

MIKANIA FILGUEIRASII R. M. King & H. Robinson, sp. nov.

Plantae scandentes. Caules non fistulosi teretes leniter striati dense aureo-tomentelli. Folia opposita, petiolis plerumque 1.0-1.5 mm longis; laminae ovatae 6-9 cm longae et 3.0-4.5 cm latae base rotundatae et trinervatae margine integrae apice anguste acuminatae supra dense pilosulae subtus pallidiores dense sericeae non glanduliferae. Inflorescentiae thyrsoideo-paniculatae, bracteis inferioribus foliiformibus in laminis 4-6 cm longis et 1.7-3.0 cm latis, bracteis superioribus lanceolatis ca. 8-20 mm longis ei 2-4 mm latis supra glabris et subtus aureo-sericeis, bracteis ramorum plerumque minute ovatis ca. 5-7 mm longis in petiolis 0-1 mm longis, bracteis subinvolucralibus sessilibus late ovatis vel orbicularis basis capitulorum late investientes plerumque ca. 4 mm longae et latae breviter obtusae vel rotundatae. Capitula in glomerulis trifidis aggregata vel interdum solitaria ca. 1 cm alta, squamae involucri late oblongae ca. 5 mm longae et 2.5 mm latae apice late rotundatae extus dense tomentellae. Corollae albae? ca. 6 mm longae extus glabrae vel subglabrae, tubis cylindraceis ca. 2.8 mm longis, limbis anguste campanulatis, faucibus 2.0-2.3 mm longis, lobis oblongo-ovatis 1.0-1.2 mm longis et 0.8-1.0 mm latis laevibus, cellulis loborum subquadratis laxis; filamenta in partibus superioribus ca. 0.35 mm longa inferne leniter latiora; thecae antherarum ca. 1.7 mm longae; appendices antherarum ovatae ca. 0.3 mm longae et 0.25 mm latae; basi stylorum laeves; rami stylorum non glanduliferi. Achaenia ca. 3.8 mm longa 5-costata puberula superne densiores, costis subalatis flavis. Setae pappi ca. 40 plerumque ca. 6 mm longae superne latiores exteriores breviores et tenuiores paucae. Grana pollinis in diametro ca. 23 μm.

TYPE: BRASIL: Distrito Federal: Bacia do Rio São Bartolomeu. Liana; folhas membanáceas, pilosas; capítulos alvos; mata ciliar. 6-VIII-1980. *Heringer, Filgueiras, Mendonca, Pereira, Heringer Salles & Chagas e Silva 5276* (Holotype, IBGE; isotype, US).

The thyrsoid inflorescence, non-fistulose stems, and non-glandular-punctate leaves all indicate relationship to *Mikania*

banisteriae DC., and its numerous relatives. Still, the pubescence of the upper leaf surface is not as coarse as in most members of the group, and the heads are mostly in distinct groups of three. The broadly investing subinvolucral bracts seems particularly distinctive. The costae in the lower part of the achenes seem very sharp and rather wing-like.

The new species is named for Tarcíso S. Filqueiras of the Reserva Ecologica do IBGE, one of the collectors of the type specimen.

MIKANIA MATTOS-SILVAE R. M. King & H. Robinson, sp. nov.

Plantae scandentes. Caules non fistulosi brunnescentes teretes leniter striati minute granulariter fulvo-puberuli. Folia opposita, petiolis 7-15 mm longis base saepe contortis; laminae ovatae 2.5-12.0 cm longae et 1-4 cm latae base rotundatae raro breviter obtusae margine integrae apice anguste acuminatae supra glabrae lucidae subtus subglabrae vel persparse puberulae in nervulis leniter exsculptae, nervis secundariis utrinque plerumque 5-6 late patentibus et distaliter valde arcuatis. Inflorescentiae thyrsoideo-paniculatae, bracteis inferioribus foliiformibus in laminis ad 2 cm longis, bracteis caetera subulatis 2-4 mm longis, bracteis subinvolucralibus minutis vel nullis, pedicellis 0-2 mm longis dense puberulis. Capitula solitaria ca. 5-6 mm alta; squamae involucri oblongae ca. 2.5 mm longae et 1 mm latae apice rotundatae margine et extus minute puberulae. Corollae albae? ca. 3 mm longae extus sparse puberulae, tubis cylindraceis 1.0-1.2 mm longis, faucibus late abrupte campanulatis ca. 0.8 mm longis, lobis ovato-triangularibus ca. 1 mm longis et 0.8 mm latis incurvascentibus laevibus, cellulis plerumque breviter oblongis in parietibus lateralibus saepe sinuosis; filamenta in partibus superioribus ca. 0.3 mm longa; thecae antherarum ca. 0.7 mm longae; appendices antherarum ca. 0.18 mm longae et latae apice late rotundatae; basi stylorum laeves; rami stylorum non glanduliferi; appendices stylorum dense irregulariter patentiter papillosae. Achaenia ca. 2 mm longa 5-costata basi et superne dense puberula, pilis uniseriatis interdum in cellulis apicalibus distinctis et resiniferis vel glanduliferis?; setae pappi ca. 55 uniseriatae plerumque 2.5-3.0 mm longae apice latiores, cellulis apicalibus obtusis vel breviter acutis. Grana pollinis in diametro 17-18 µm.

TYPE: BRASIL: Bahia: Município de Maraú. Fazenda Agua Boa, BR 030, a 22 km a E de Ubaitaba. Ca. 100 m de altitude. Trepadeira. 25 agosto 1979. *S.Mori 12739* (Holotype, CEPEC; isotype, US). PARATYPE: BRASIL: Bahia: Município de Mucuri. 14-17 km a W de Mucuri. Capoeira e mata perturbada. Folha SE-24 (18-40d). 13 Setembro 1978. *S.A.Mori, L.A.Mattos Silva & T.S.dos Santos 10430* (CEPEC).

The new species is notable for the pinnately veined leaves, solid pith, and the lobes of the corolla that become strongly incurved. The leaves are reminiscent of those described for

M. vautheriana Baker and *M. ligustrifolia* DC., but the latter have racemose branches in the inflorescence. The hairs of the stems, corollas, and achenes seem to include many that have a differentiated glandular apical cell. These hairs in no way resemble the normal biseriate glandular hairs seen in many members of the Asteraceae.

MIKANIA PSEUDOMICROCEPHALA R. M. King & H. Robinson, sp. nov.

Plantae scandentes? Caules non fistulosi subhexagonales leniter striati dense hispidae. Folia opposita, petiolis plerumque 1.0-2.5 cm longis; laminae ovatae ad 6 cm longis et 4 cm latis base late rotundatae trinervatae margine integrae apice breviter acutae supra sparse puberulae subtus subtomentellae in nervas densiores non glanduliferae. Inflorescentiae thyrsoideo-paniculatae, bracteis primariis foliiformibus in laminis ad 5 cm longis, bracteis secundariis et tertialibus minutis subulatis, bracteis subinvolucralibus perminutis linearibus 0.5-1.0 mm longis. Capitula sessilia ca. 4 mm longa; squamae involucri oblongae vel ellipticae ca. 2.5 mm longae et 0.8-1.0 mm latae apice rotundatae margine puberulo-fimbriatae extus plerumque glabrae subapice sensim puberulae. Corollae albae ca. 2.5 mm longae, tubis cylindraceis ca. 0.7 mm longis extus pauce glandulo-punctatis, faucibis late infundibulares ca. 1 mm longis extus glabris, lobis reflexis ovatis 0.7-0.8 mm longis et ca. 0.5 mm latis extus superne pauce glandulo-punctatis utrinque laevibus, cellulis loborum oblongis in parietibus lateralibus interdum sinuosis; filamenta in partibus superioribus ca. 0.25 mm longis; thecae antherarum ca. 0.7 mm longae; appendices antherarum ca. 0.18 mm longae et latae apice late rotundatae interdum breviter obtusae; basi stylorum glabri; rami stylorum in axillis uniglanduliferi caeterum non vel vix glanduliferi, appendices stylorum lineares dense breviter papillosae. Achaenia ca. 1.7 mm longa 5-costata superne pauce glandulifera, setae pappi ca. 25 uniseriatae plerumque 1.8-2.2 mm longae superne leniter latiores, cellulis apicalibus obtusis vel anguste rotundatis. Grana pollinis in diametro ca. 20 μm.

TYPE: BRASIL: Minas Gerais: Margem da Rodovia Nanuque - Teófilo Otoni. Serra rochosa. Cipó. Flôres brancas, caule avermelhado. 14-8-1965. *R.P.Belem 1630* (Holotype, CEPEC).

The type specimen was determined as *Mikania microcephala* DC., and the latter may be the closest relative. The two share many characters including the extremely small heads. The DeCandolle species differs by the leaves with crenate to dentate margins and glandular punctate undersurfaces; by the heads that are not sessile; by the corollas that have more sharply defined tubes, more numerous glands, and more broadly triangular lobes; by style branches having numerous glands abaxially; and by the achenes having scattered small setulae in addition to the glands.

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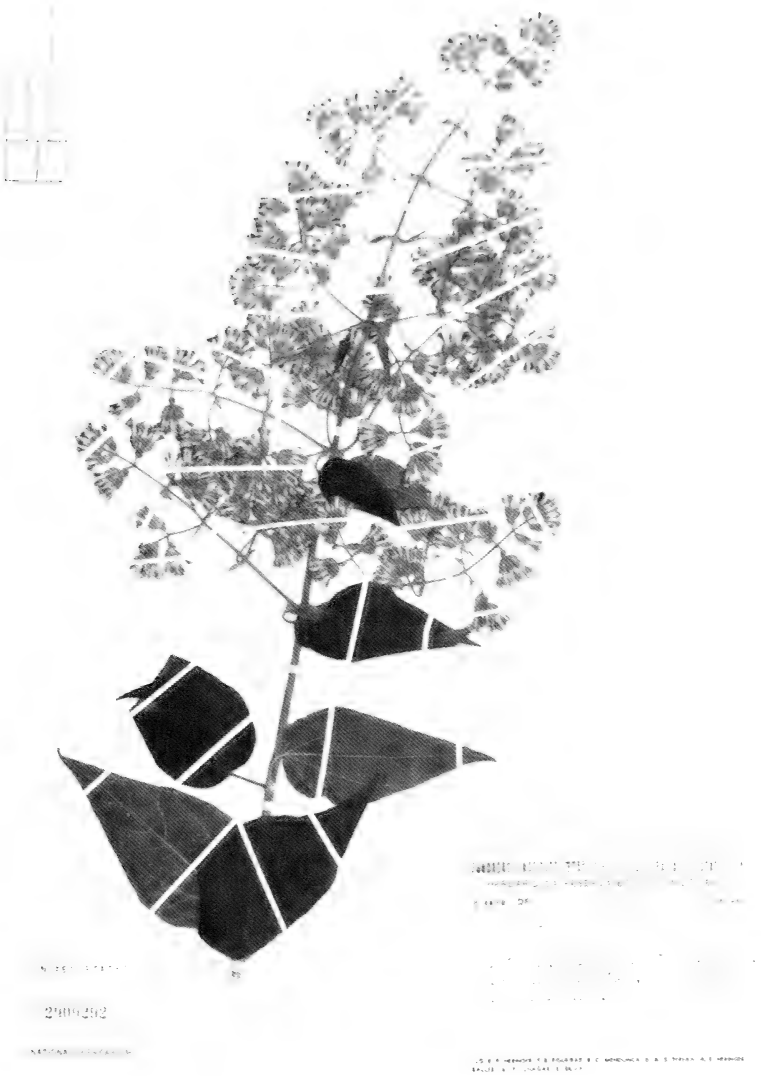

Mikania filgueirasii R. M. King & H. Robinson, Isotype, United States National Herbarium. Photos by Victor E. Krantz, Staff Photographer, National Museum of Natural History.

Mikania mattos-silvae R. M. King & H. Robinson, Isotype, United States National Herbarium.

Mikania pseudomicrocephala R. M. King & H. Robinson, Holotype, Herbário Centro de Pesquisas do Cacau (CEPEC), Itabuna, Bahia.

Enlargements of heads of *Mikania*. Top. *M. pseudomicrocephala*. Middle. *M. mattos-silvae*. Bottom. *M. filgueirasii*.

A NEW SPECIES OF *VERNONIA* FROM BRASIL

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The new species described below was first known to the author nearly two years ago on the basis of an immature specimen which was noted by the collectors as a possible *Barnadesia* because of a general resemblance to some Mutisieae. A second specimen was subsequently seen, but the heads were infested with gall insects and the tribe still could not be determined with certainty. Through the kindness of the staff of the Herbario Centro de Pesquisas do Cacau, a duplicate of the first collection has now been seen, and the distinctive species falls within the broad limits of the genus *Vernonia* in the tribe Vernonieae.

VERNONIA VIHNAE H. Robinson, sp. nov.

Plantae fruticosae ad 1.5 m altae mediocriter ramosae. Caules nigrescentes subteretes leniter striati dense appresse pilosuli, pilis sessiliter T-formibus. Folia alterna, petiolis 3-10 mm longis superne indistincte demarcatis; laminae ellipticae vel obovatae 4-12 cm longae et 1.8-4.5 cm latae base cuneatae vel acuminatae margine anguste reflexae superne sensim pauce serrulatae apice obtusae vel truncatae dense multo denticulatae vel sub praemorsae supra et subtus epilosae et minute glandulo-punctatae leniter exsculptae, nervis secundariis utrinque 4-9 ca. 30-45° ascendentibus non arcuatis. Inflorescentiae terminales subdense corymboso-cymosae pauci-capitatae, bracteis minutis, ramis ultimis 0.8 mm longis. Capitula late infundibulares 15-18 mm alta et ca. 8-10 mm lata; squamae involucri ca. 40 subimbricatae ca. 6-seriatae 4-14 mm longae et 2-3 mm latae plerumque praeter interiores rotundatae et minute puberulo-fimbriatae extus glabrae exteriores subapice prominentiter carnose umbonatae. Flores ca. 20; corollae rosaceae ca. 17 mm longae, tubis ca. 11 mm longis perangustis superne sensim infundubulares, faucibus 1.0-1.5 mm longis, tubis et faucibus extus glabris, lobis linearibus ca. 5 mm longis et 0.7 mm latis extus sensim dense glandulo-punctatis subapice pauce spiculiferis; thecae antherarum ca. 4.3 mm longae; appendices antherarum anguste ovatae ca. 0.7 mm longae et 0.35 mm latae glabrae; basi stylorum breviter obturaculiformes; scapi stylorum in partibus superioribus hispidulis ca. 1 mm longi; rami stylorum ca. 1.5 mm longi argute pilosuli. Achaenia ca. 3.5 mm longa glabra inferne leniter mamillosa; setae pappi ca. 50 exteriores 3-9 mm longae apice tenuiores, interiores ad 11 mm longae apice latiores omnino sublaeves vel leniter scabridulae. Grana pollinis in diametro ca. 50 µm irregulariter distincte

areolata et spinulifera (near *Lychnophora*-type but larger and with ireegular spinulose ridges more sharply defined.

TYPE: BRASIL: Bahia: Ubaitaba-Maraú, C. rosada. Na psamofitia. 13 XII 1967. *S.G.da Vinha no. 57 & A.Castellanos* (Holotype, CEPEC; isotype, US). PARATYPE: BRASIL: Bahia: Município de Maraú. BR 030, a 45 km a E de Ubaitaba. Ca. 25-50 m de altitude. Campos. Arbusto, 1,5 m de altura. 27 agosto 1979. *S.A.Mori, A.Walther & A.Necker 12812* (US).

The new species is initially distinguishable by the teeth that are concentrated at the rather truncate to slightly retuse apex of the leaf, by the fleshy umbos on the involucral bracts near the tips, and by the poorly differentiated outer pappus. Two of these characters can be seen in both specimens, but floral details cannot be confirmed in the paratype material because of the infestation with some type of gall-insect. The species is unusually distinctive, but seems to be most closely related to *V. crassa* (Vell.) Ekman of Parana and *V. squamulosa* Hook. & Arn. of northern Argentina north to S. Paulo in Brasil. Both of the latter have short-acute leaf apices, simple tips on the involucral bracts, a distinct short squamulose outer pappus, hairs on the achenes, and pubescence on the undersurfaces of the leaves. In *V. crassa* the leaves have a dense cover of tomentum below, while the narrowly elliptical leaves of *V. squamulosa* are only puberulous below.

Another possible relative is represented by a type photograph of *Vernonia retusa* Sch.Bip., nom. nud. (Brasil: Rio das Pedras, 20 Apr. 1826, *Sello*, Berlin, probably destroyed). Sello's itinerary would place the locality in northern Uruguay or southern Rio Grande do Sul in Brasil. The photograph shows a plant similar to *V. vinhae*, but with more simply retuse leaf tips and no umbos on the involucral bracts.

Vernonia vinhae H. Robinson, Holotype, Herbário Centro de Pesquisas do Cacau (CEPEC), Itabuna, Bahia. Photo by Victor E. Krantz, Staff Photographer, National Museum of Natural History.

Cerenkov Counting Technique for Beta Particles: Application to Tracer Studies in Biological Systems.

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Cerenkov radiation was first utilized for measurement of beta radiation only in mid-1960's even though the first observation of Cerenkov radiation was made by Mme. Curie in 1910. The use of this counting technique increased in the late-1960's and has become a routine assay technique for high-energy beta emitters. A number of reviews of this technique has appeared in the last decade (2-11). This technique is rarely used in biological tracer work involving high energy beta emitters, in spite of a decade of developments in Cerenkov counting. A survey of articles published in 1979 indicated that only one in twenty researchers utilized the Cerenkov counting technique in ^{32}P tracer studies. The aim of this paper is to present the advantages of Cerenkov counting for biological systems. Tracer work performed to determine the phosphate uptake in Saccharomyces cerevisiae Hansen wild type and phenotypes exposed to space flight irradiation is used as an example.

Theory: When a beta particle (or any charged particle) travels with a velocity greater than light in a specified medium, Cerenkov radiation is emitted. Since the refractive index of a medium is related to the velocity of light in that medium, the condition for Cerenkov radiation can be expressed as $v > c/n$ where v is the velocity of the beta particle, c is the velocity of light in vacuum and n is the refractive index of the medium. In many tracer studies aqueous solutions are counted. The refractive index for water is 1.332 which leads to a value of 263 keV as the minimum kinetic energy the beta particle must have to exceed the velocity of light in water and emit Cerenkov radiation. Since the particles emitted in a beta decay have a continuous energy spectrum the E_{max} (i.e. the maximum energy of the beta particles) should be much higher than 263 keV for usable Cerenkov radiation. Of the three most commonly used tracers in biological systems, namely, ^{3}H(E_{max} 18.6 keV), ^{14}C (E_{max} 156 keV) and ^{32}P (E_{max} 1710 keV), the latter is ideally suited for Cerenkov counting. The current study utilized ^{32}P as the tracer. For additional theoretical information refer to Ross (10), Horrocks (4) and Kobayashi and Maudsley (6).

Materials and Methods: Carrier-free ^{32}P was obtained from New England Nuclear. Searle Analytic Delta 300 liquid scintillation spectrometer system was used for counting without any modification. Stock cultures of S. cerevisiae were maintained on Sabouraud dextrose agar at 25 C.

S. cerevisiae yeast cells were grown in a Virtis Fermenter model 40-100-A in dextrose broth three days under aerobic conditions at 24 C. Yeast cells were starved for 24 hours in 5 % (w/v) glucose solution followed by a three-day starvation period in distilled H_2O. The cells were washed three times with distilled H_2O before use.

The phosphate uptake experiment was conducted at room temperature under aerobic conditions. To the growth solution containing yeast cells, glucose and succinic acid (pH adjusted to 6.5), 5 ml of 8.8 μM potassium dihydrogen phosphate (KH_2PO_4) solution containing approximately 5 μCi of ^{32}P was added. The suspension was mixed continuously. Periodically 2 ml samples were withdrawn from the reaction vessel for phosphate analysis. Further experimental details have been published elsewhere (1).

The 2 ml yeast suspension withdrawn from the reaction vessel was delivered to a polyethylene centrifuge tube containing 3 ml 4 % trichloracetic acid. The contents mixed well and centrifuged immediately in a Sorvall superspeed centrifuge at 2445 x g for 5 minutes. From the supernatant, 1 ml was carefully pipetted and delivered to a polyethylene counting vial containing 14 ml distilled H_2O. The ^{32}P activity was measured in the Searle Delta 300 liquid scintillation spectrometer system using window settings of 0.0 and 5.0 V for lower-level and upper-level discriminators respectively.

In order to check for differences in color quenching (due to chemicals produced as a result of yeast metabolism), one set of samples was set-aside until the ^{32}P tracer decayed essentially completely. After storage the vials were examined to ensure that no contamination due to bacterial or fungal growth was present. To each vial, approximately 0.004 μCi ^{32}P in 2 ml solution were added. A set of six standards were prepared by pipetting 2 ml ^{32}P tracer solution into vials containing 15 ml distilled water. All samples were counted as described.

Results and Discussion: During the present study of phosphate uptake by S. cerevisiae the Cerenkov counting technique was found to be convenient, efficient and economical. Table 1 shows the counting data obtained from a typical run. The change in the count rate between samples was used to calculate the average rate of phosphate uptake. Data obtained for checking color quenching are shown in Table 2. The count rate obtained for the ^{32}P added to the different vials fall within the 99 % confidence limits, calculation based on the count rate of the set of standards, indicating the absence of quenching due to materials produced by S. cerevisiae metabolism. The results of this phosphate uptake study have been published elsewhere (1). Advantages and limitations of the Cerenkov counting technique warrant discussion.

In the phosphate uptake experiment, the sample preparation simply arrested the growth and separated the yeast cells from the medium containing unused phosphate. After separation, the solution was diluted with water to proper volume necessary for counting. In other types of experiments, if an ion-exchange separation (in aqueous medium) is involved, the effluent containing the tracer could be counted directly. If paper chromatographic separation or thin-layer

chromotographic separation precedes the assay, then the material could be leached out with appropriate aqueous solvent (water, dilute acid or alkali) and counted. The specific advantage of Cerenkov technique is that large volumes (20 ml) of solutions containing ionic materials could be counted. Contrarily in liquid scintillation counting the scintillation cocktail can disperse only about 10 - 15 % of its volume, i.e. 2 to 3 ml for the maximum counting volume of 20 ml. If large volumes (15-20 ml) can be withdrawn for assay, then the amount of tracer or labelled compound used for the experiment can be reduced.

Three approaches are possible when material to be counted is not soluble in aqueous media. First, material may be decomposed, e.g. with concentrated acid, forming an aqueous solution for counting. Secondly, the solution in an organic solvent may be used with the solvent acting as Cerenkov medium. Toluene with a refractive index of 1.496 would be a better Cerenkov medium. Finally, the use of a liquid scintillation cocktail is a possibility. The choice technique would be the third listed since the first requires time consuming operations while the second method does not offer any special advantage but has the disadvantage of lower counting efficienty.

One of the advantages of the Cerenkov technique is the reduction of difficulties associated with waste disposal, expecially for smaller institutions which do not have a Radiation Safety group to take care of waste disposal. Storage for disposal does not involve flammable materials. If the radioactive tracer is short-lived, e.g. 14-d ^{32}P, the waste can be stored until ^{32}P decays essentially completely and then disposed of through sewage according to regulations governing radioactive waste disposal, if no biologically hazardous material is present in the waste.

Cerenkov counting can be used with any beta emitter which has a good fraction of beta particles with energy above the threshold, namely 263 keV for aqueous solutions. Horrocks lists the fraction of beta particles exceeding 263 keV for typical beta emitters used as tracer in biological experiments (4). ^{36}Cl with an E_{max} of 714 keV has 46 % of the beta particles above 263 keV, while ^{32}P with an E_{max} of 1710 keV has 86 % of the beta particles above the threshold value. The actual counting efficiency obtainable in aqueous solution by this technique will depend on the type of photomultipliers used in the liquid scintillation spectrometer system and also the actual arrangement of the photomultipliers. Typical efficencies obtained for a number of nuclides with two different liquid scintillation spectrometer systems are reported by Parker and Elrick (8); with high efficiency photocathode they obtained a 5.3 % counting efficienty for ^{36}Cl and a 43.33 % efficiency for ^{32}P (10 ml volumes). In this work an efficiency of 51 % was obtained for ^{32}P (15 ml volume) with the Delta 300 system. From the data of Parker and Elrich, it is clear that E_{max} of the tracer should be above 700 keV in order to obtain reasonable Cerenkov counting efficiency.

Color quenching occurs in Cerenkov counting just as in liquid scintillation counting. Techniques used in liquid scintillation

counting for correcting color quenching include internal standardization, external standardization and the channels ratio method. A number of papers have appeared in the literature discussing various quench correction techniques as applied to Cerenkov counting. Parker (7) reviewed the various options available while Kamp and Blanchard (5) discussed specifically channels ratio and external source-channels ratio methods. In the current study the internal standardization method was used. Fric and Palovcikova (3) found channels ratio method to be satisfactory for the Cerenkov counting of ^{32}P in plant extracts. In general, color quenching correction is comparable to that of low energy beta emitters in liquid scintillation counting.

Unlike liquid scintillation counting, chemical quenching is absent in Cerenkov counting. However, large variations in the concentration of solutes between different counting vials could lead to different counting efficiencies because of changes in density and refractive index of the media. Hence, large concentration changes should be avoided.

Summary: In many biological studies high energy beta emitters are used as radioactive tracers. Cerenkov counting technique can be used advantageously for the assay of such radioactive materials. Costs are reduced since no scintillation cocktail is used. The technique also reduces waste disposal problems. Both advantages and limitations found in the technique are presented. A study of phosphate uptake in Saccharomyces cerevisiae Hansen wild type and phenotypes exposed to space flight irradiation using ^{32}P serves as an example to illustrate sample preparation and quench correction.

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Table 1: Cerenkov counting results of ^{32}P phosphate uptake by S. cerevisiae.

Sample No.	Sample withdraw time (min)	Net activity cpm-background
1	1	32288
2	16	11093
3	31	673
4	46	626
5	61	665
6	76	774
7	91	992
8	106	1145
9	121	1231

The decreasing trend in counts per minute (cpm) shown in the net activity column represents disappearance of phosphate from the medium. After 61 minutes of phosphate uptake yeast-cells began to release the labelled phosphate ^{32}P. Each sample was counted for 10 min.

Table 2: Checks for color quenching.

Sample No.	Net activity cmp-background
1	4159
2	4110
3	4060
4	4086
5	4034
6	4208
7	3993
8	3969
9	3969

Net activity, based on a ten-minute measurement, represents the counts due to 2 ml of ^{32}P tracer solution added to each vial. A set of six standards prepared using 2 ml of ^{32}P tracer solution and 15 ml of distilled water gave a value of 4108 $\pm$ 214 cpm at 99 % confidence level. Count rate of all sample vials fall within this limit indicating no quenching due to materials produced by S. cerevisiae metabolism.

BOOK REVIEWS

Alma L. Moldenke

ANNUAL REVIEW OF PHYTOPATHOLOGY Volume 19" edited by Raymond G. . Grogan with George A. Zentmyer & Ellis B. Cowling, x & 494 pp., 20 b/w fig., 22 tab., 2 photo. & 3 maps. Annual Reviews Inc., Palo Alto, California 94306. 1981. $20.00 in U.S.A., $21.00 foreign.

I have always found the Prefatory Chapter an appreciatively charming and humanely warming feature of this series as it fleshes out the scientist so recognized and surveys his own training, thinking and scientific experiences. Lately added are shorter Historical Perspectives on three pioneer leaders in plant pathology -- Gerard Thorne, W. J. Dawson and G. W. Keith. The following score of scientific papers report a wide range of recent careful work with which students, researchers, professors, and trained government authorities should be cognizant. A few of the titles are: Tissue replacement diseases caused by fungi, Role of phytostilbenes in decay and disease resistance, Changing concepts in host-pathogen genetics, and Solarization of soil for control of soilborne pests.

"VEGETATIONSKARTE VON SÜDAMERIKA" or "MAPA DE LA VEGETACION DE AMERICA DEL SUR" Second Edition with bilingual text by Kurt Hueck & Paul Seibert, x & 90 pp. & 1:8 million colored map folded in back cover pocket. Gustav Fischer Verlag, New York & Postfach 7201 43, D-7000 Stuttgart 70, West Germany. 1981. DM 39 paperbound.

The second author has organized and modernized this text working from Hueck's valuable first edition of 1966 by adding over 300 pertinent titles to the bibliography and about 1,000 vegetative place names to the map after 12 years of work in the field. The excellence of the original edition is perpetuated and enhanced in this new one. This map and text will prove to be very important to many kinds of scientific workers in or interested in South America.

"PLANT PATHOSYSTEMS" by Raoul A. Robinson, 184 pp., 2 b/w tab. & 15 fig. Springer-Verlag, Berlin, Heidelberg, & New York, N. Y. 10010. 1976. $25.00.

It is fortunate that this challenging third number in the Advanced Series in Agricultural Sciences is still readily available. With meticulous definitions of all terms and new concepts of pathosystem analysis and management, the author shows why and how "boom-and-bust" cultivar breeding should be replaced by cumulative plant breeding.

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Index to supra-specific scientific names in Volume Forty-nine

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